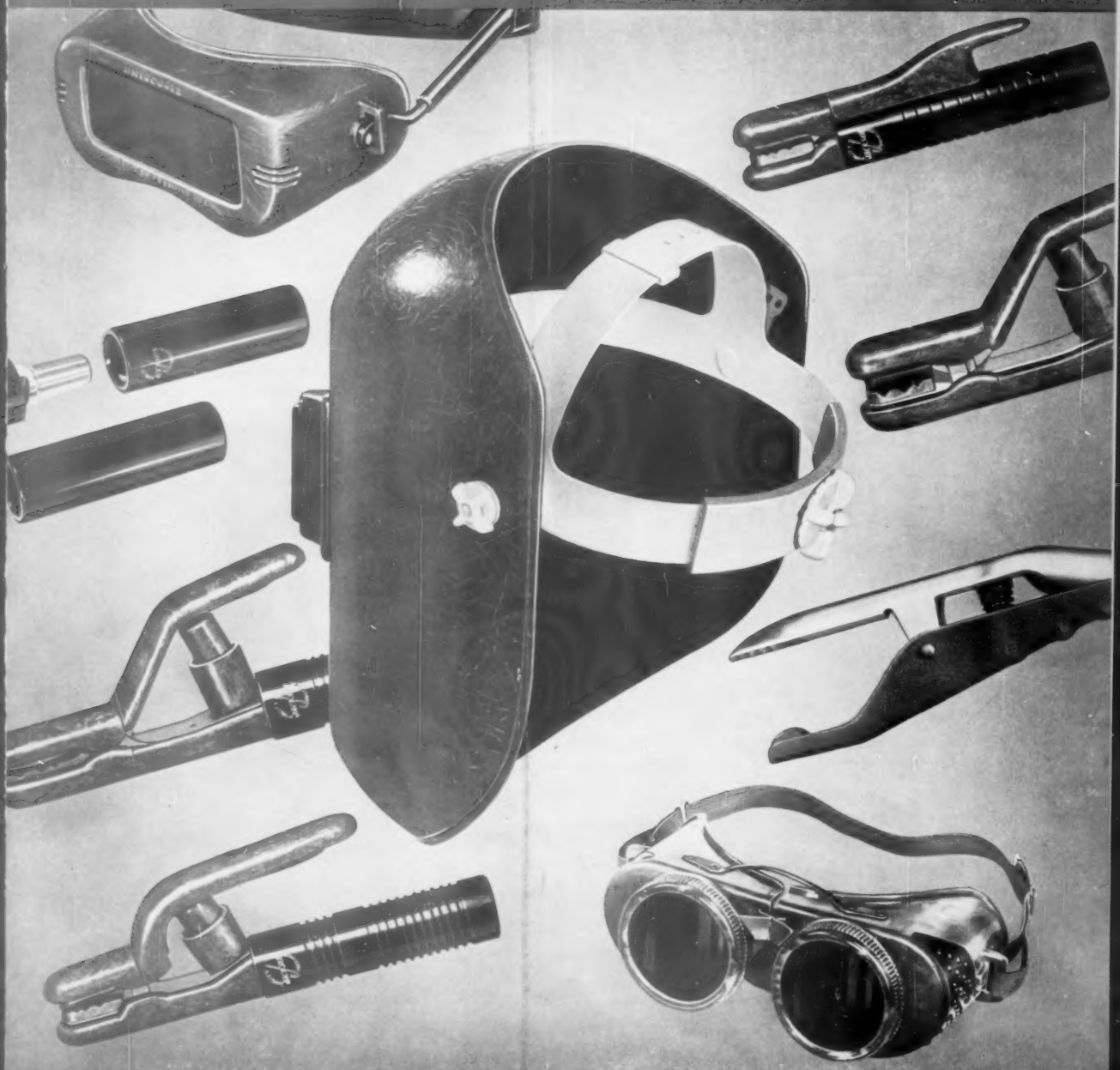
Welding Engineer

PRICE 50 CENTS

FEBRUARY, 1956



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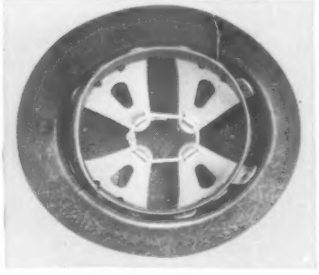

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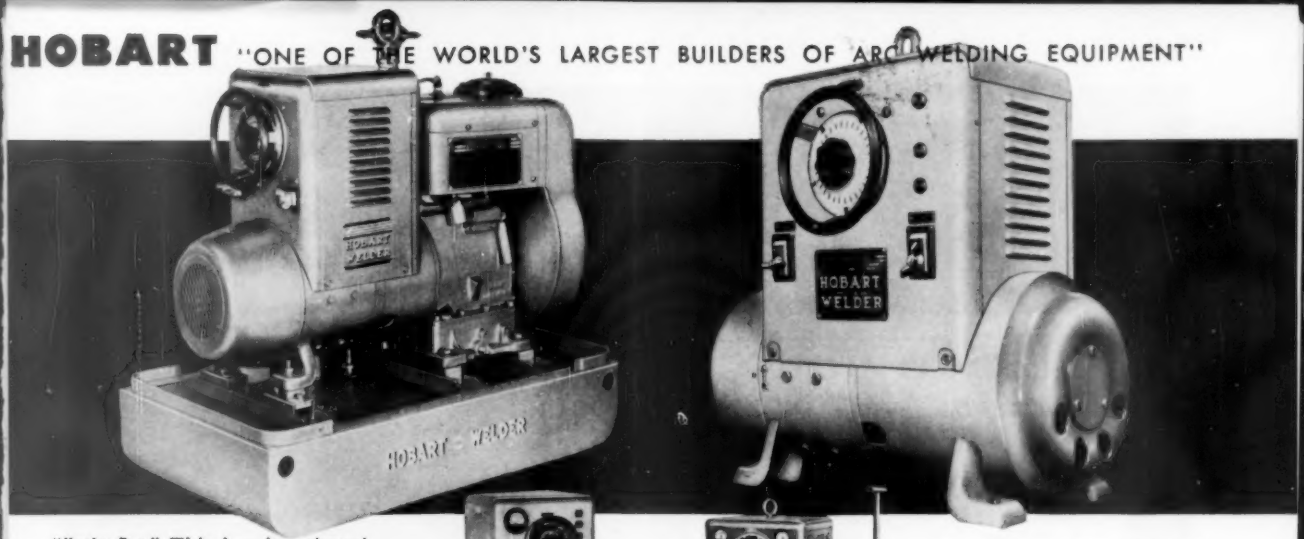

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Air-cooled AC Power—AC Welder. It's a 2-in-1 unit. It welds anywhere or supplies power for operating tools, lights, pumps, paint sprays, etc., independent of power lines.

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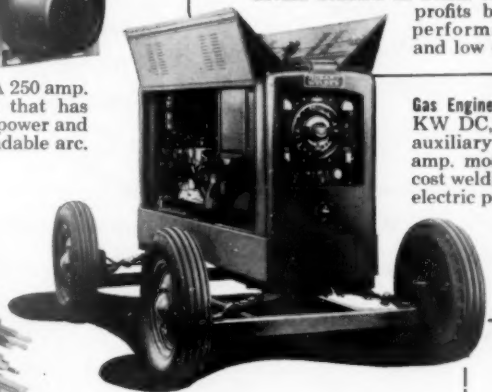
Gas Engine Welders with 1 or 3 KW DC, or 6 or 12 KW AC auxiliary power. 200 to 600 amp. models for speedy, low cost welding in the field where electric power is not available.



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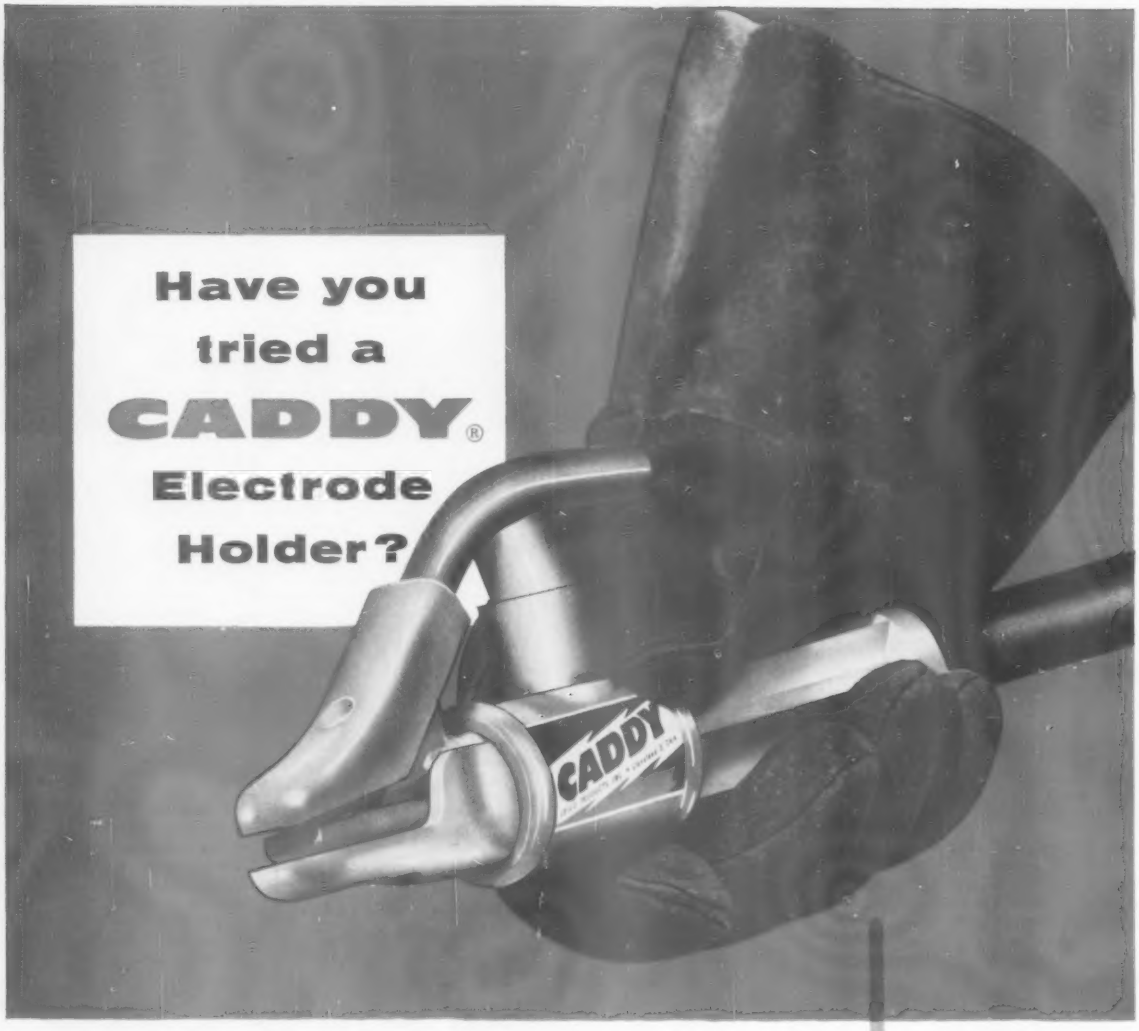

You should—and here's the reason why: 9 out of every 10 companies that tested CADDY Electrode holders in 1955 switched to CADDY as their standard unit.

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ERICO PRODUCTS, INC.
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COMPANY _____

ADDRESS _____

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Welding Engineer

FEBRUARY, 1956
VOL. 41—No. 2

A MAGAZINE OF JOINING AND SEVERING OF METALS

America's pioneer publication which, combined with The Acetylene Journal, has been devoted to the interest of the welding and allied industries since 1898

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JOB SHOP

Arc-cutting and gouging speeds oil drill repairs 21

MAINTENANCE

Big problems are commonplace in flame-treating oil industry tools 28
R. F. Arnoldy

CONSTRUCTION

Welded bridge sets a new length record 46
Hugh Jarman

FABRICATION

Oil rigs made stronger by Mig, submerged-arc 25
Spot welding aircraft parts 42

OPERATION

Filler metals for joining 31
Orville T. Barnett
Hardfacing positioner doubles production 36

INSPECTION

On-the-job tests for pipe weldors 27
Jack Fairlie

RESEARCH

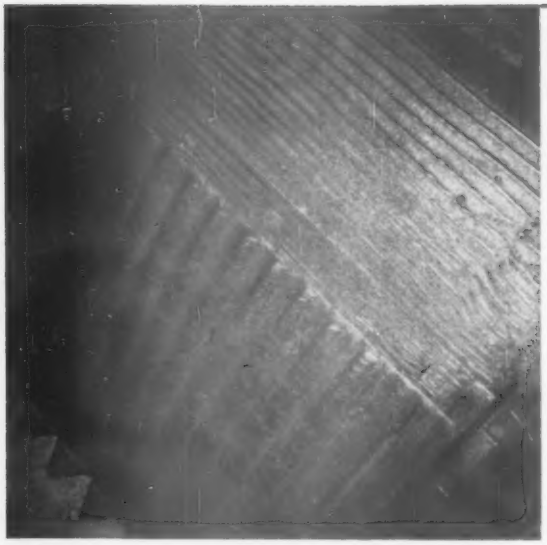
Comparative testing confirms oxypropane cutting value 22
Jay Bland

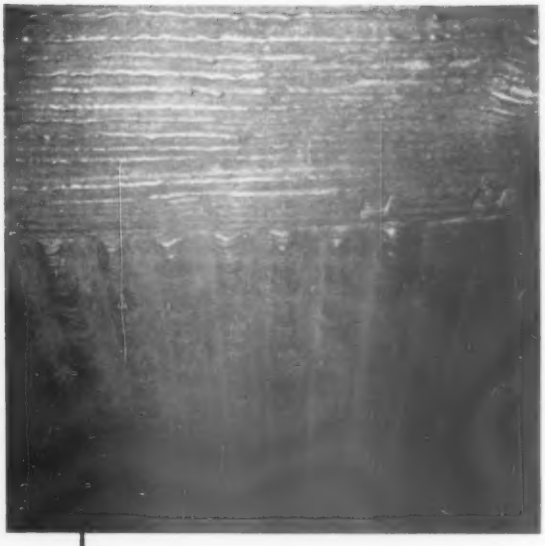
OPINION

The need for unity 44
Van Rensellaer P. Saxe

DEPARTMENTS

News 5
Letters to the editor 9
Editorial: Keep pace with progress 19
A Weldor's Woes: cartoon feature 26
The welding clinic: LP gas flame-cutting adjustment 52
Data Sheet No. 185: Weight of weld metal 55
New Products 58
People 82
30 years ago 85
Advertisers in this issue 86
Where to buy 86
The Welding Shopper 87
Free literature 88
Welding Info-Aids 89
Literature offered in ads 90





how to EXTEND working life of jaw crushers

apply VICTOR HARDFACING

No Disassembly This jaw crusher was hardfaced with jaws bolted in place, using 3/16" coated Tube Victorite. Despite cramped working area only 12" deep and 36" wide, high deposition rate and low spatter loss enabled welder to get uniform, non-sagging, long-wearing bead without distorting jaw.

Downtime Saver Because it goes on fast, without flux interference, and sets up quickly, coated Tube Victorite is wonderful for hardfacing on the job without disassembly of equipment.

Where To Use Coated Tube Victorite is a high alloy content rod with Rockwell C hardness of 55-58. It was developed specifically for tools subject to severe abrasion and impact, such as:

- Ripper Teeth
- Pug Mill Augers
- Jaw Crushers
- Roll Crushers
- Die Rings
- Tool Joints
- Scraper Blades
- Asphalt Mixer Paddle Shanks
- Mill Hammers
- Bucket Lips

It welds easily to carbon alloy and manganese steels—the latter frequently is used for buildup before applying coated Tube Victorite. It can be used for position welding. Deposit is smooth, even, free of pin holes. Made for AC and DC (reverse polarity) application.

Free Help—Victor hardfacing manual shows you the right rod to use and how to apply it. Ask your Victor dealer for manual and descriptive leaflets on Tube Victorite and other Victor rods . . . or write us.

Profitable dealerships open; inquire now!

VICTOR for hardfacing

VICTOR EQUIPMENT COMPANY
ALLOY ROD & METAL DIVISION
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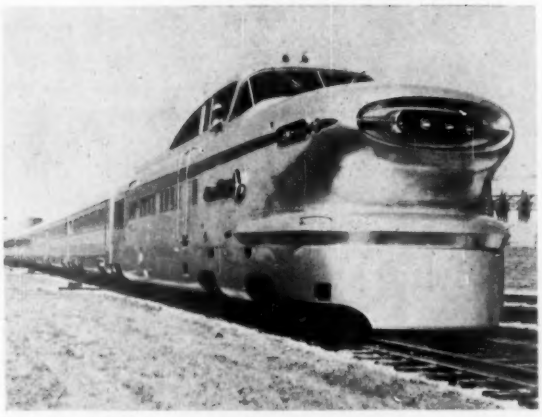
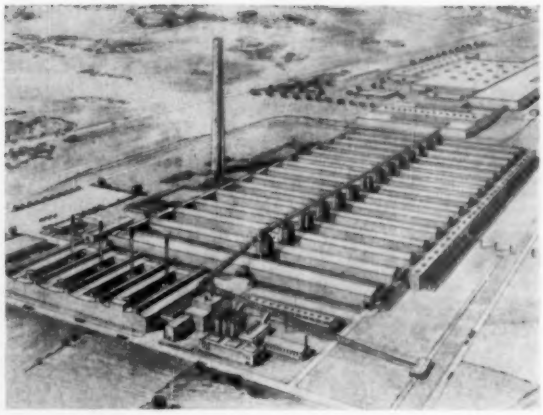


UNUSUAL design and lightness of new Aerotrain will contribute to better passenger service. Streamlined Aerotrain recently made its maiden run. (See story below.)



ALUMINUM reduction plant, foreground, to be built at Ravenswood, W. Va., will have 220,000 ton capacity. In background is sheet and foil rolling mill now under construction. (See story below.)

News

Experimental trains ready for service

Ready for operation on the Rock Island Lines, New York Central System and Pennsylvania Railroad are the Talgo train and the Aerotrain.

Manufactured by the American Car & Foundry Division of ACF Industries, Inc., New York City, the Talgo train was designed in Spain. It has been in operation there for six years. Incorporating many welded features for lightness and strength, the articulated, Diesel-powered streamliner can safely navigate curves at higher than average speeds.

The Aerotrain, a principal feature of the 1955 General Motors Powerama display in Chicago, is a 10-coach, 400-passenger train. It weighs 50% less than conventional models. The locomotive was fabricated largely with welding. Coaches (also welded) are four-wheel modifications of aluminum intercity bus bodies.

Grinding wheels are electronically planned

Automation has come to the grinding wheel. Hailing it as an industry first, Bay State Abrasive Products Co. has linked electronic computing equipment with a punch card system to calculate manfacturing formulas for all grinding wheels. The new process, termed "electronic formulation," is said to calculate in seconds and to perform without error.

Formulas for the wide variety of grinding applications met in industry are only a step toward greater automatic control, according to Bay State. It will not be long before electronic computers will be used in manufacturing processes, actually selecting ingredients, measuring, combining and processing them, states the Westboro, Mass., manufacturer.

In this issue . . .

Linde Air Products Co. photo

Four special articles detail numerous ways in which welding, flame-cutting and allied processes are put to valuable use in producing and maintaining equipment for the oil industry. Major parts of the heavy-duty winch pictured above, for example, were welded. *Don't miss this exclusive coverage.*

Kaiser Aluminum expands plant

An expansion program that will bring total primary aluminum capacity up to 654,000 tons per year has been announced by Kaiser Aluminum & Chemical Corp., Oakland, Calif. Major projects under the program will be construction of a 220,000 aluminum reduction plant at Ravenswood, W. Va., and a 500,000 ton alumina plant on the Mississippi River near Gramercy, La. Construction is planned by April.

NCG purchases Denver Oxygen Co.

National Cylinder Gas Co., Chicago, has acquired Denver Oxygen Co. Denver Oxygen will operate as a subsidiary of National Cylinder Gas.

Western Oxygen Co., Pueblo, Colo., has also joined National Cylinder Gas Co. It will operate as a division of Denver Oxygen. Both firms will retain present names. Western Oxygen's Denver branch, however, will operate as part of Denver Oxygen.

W. C. Hopkins, Denver Oxygen sales manager, will act in a consulting capacity to all three companies. H. W. Neil, formerly Cincinnati district manager of National Cylinder Gas, has been appointed manager of Denver Oxygen. He will be assisted in Pueblo by N. G. Newton.

RWMA adds two members

Peer, Inc., Benton Harbor, Mich., and Goodrich Welding Equipment Corp., Hudsonville, Mich., have joined the Resistance Welder Manufacturers' Association, Philadelphia.

News

from page 5

LATEST equipment and automatic accessories are important part of new manufacturing plant. (See story below.)

CYLINDER lift, shown in operation, has proved boon to welding supply distributor. (See story below.)

Weldaloy Products in larger quarters

Weldaloy Products Co. recently moved into its new office and plant at 11551 Stephens, Van Dyke, Mich. It was formerly located at 25753 Groesbeck Highway, East Detroit, Mich.

The new facilities consolidate the firm's general offices in one building and the foundry, with the metallurgical laboratory in another. The foundry incorporates latest types of metals melting equipment and automatic accessories.

Weldaloy manufactures standard and special resistance welding electrodes for a variety of welders. It also produces a variety of other welding products and accessories. With the new facilities in operation, Weldaloy plans to expand product development.

Glendale Optical in new plant

Glendale Optical Co., Inc., has moved into its new plant which combines factory, sales offices and general offices. The firm's new address is 600 W. Merrick Rd., Valley Stream, L. I. N. Y. Glendale Optical was formerly in Copiague, N. Y.

AWS spring show to be Buffalo

The fourth welding show sponsored by the American Welding Society will be held May 9 to 11 in the Memorial Auditorium, Buffalo, N. Y. All floor space has been reserved, with about 100 companies exhibiting. The annual business meeting and a series of technical conferences will be held May 8-11.

The American Society of Mechanical Engineers will join in sponsorship of four technical sessions; Atomic Energy Commission in one. Twenty-one technical sessions with 50 speakers are planned.

Mallory-Sharon to expand

As the first step in expansion of titanium production, Mallory-Sharon Titanium Corp., Niles, Ohio, has purchased a rolling mill in Niles. The mill was formerly owned by Sharon Steel Corp.

Discuss welding uses at Madison

Participants at the welding applications institute to be held Feb. 22, 23 and 24 at the University of Wisconsin, Madison, will hear the following speakers:

R. C. Steveling, A. O. Smith Corp., on contact electrodes; D. C. Smith, Harnischfeger Corp., on mild steel, and other electrodes; J. J. Chyle, A. O. Smith Corp., on mixed gases; A. L. Schaeffler, Allis Chalmers, on stainless steel welding; L. J. Larson, Allis Chalmers, on distortion control; I. R. Bartter, Automatic Welding Co., on material selection; R. W. Emerson, Pittsburgh Piping & Equip. Co., welding pressure piping; Cecil C. Peck, Cecil Peck Co., on automation. (For complete program listing see p. 6, WELDING ENGINEER, January, 1956.)

West coast distributor takes lift from cylinder

Installation of a cylinder lift in its new store has made life easier for California Welding Supply, Stockton, Calif. The hydraulic lift answers the back-breaking difference between dock and truck height. "Doc" Raymond and Ira Felkins, owners of California Welding feel other welding supply distributors would profit from use of such an aid. The new store is at 405 N. Lincoln. The firm has a branch store at Lodi, Calif.

—Courtesy Rankin Mfg. Co.

Welding supply firm formed in Chicago

John Ardagh and John R. Coffey have organized Ardagh Welding Supply Co., located at 4626 W. Lawrence Ave., Chicago. Mr. Ardagh, prior to organizing his own firm, was assistant sales manager for Johnson Welding Equipment Co., Chicago. He has been associated with the welding industry for over 35 years and spent 25 years in sales in Chicago with the Lincoln Electric Co.

New method of radiography

A new method of producing radiographic images without use of photosensitive materials has been developed by U. S. Naval Ordnance Laboratory, Silver Spring, Md. The new process, termed "iconography," utilizes X-ray ionization of air which

(Continued on page 74)

2 safety valves . . .

quickly adjustable but entirely tamper proof

Only an Allen wrench of proper size will adjust the pressure setting of these "*self-reseating*" relief valves. They are tamper proof and cannot be made inoperative by unauthorized and inexperienced individuals.

safety—that's their only business

and, to be safe they must have the ability to stay safe . . .

These two, self-reseating, safety valves fully protect both the first and second reduction stage of this regulator. The relief valves, both of identical design and construction and with interchangeable parts, are factory set to work at pressures slightly beyond proper working pressure maximum. Your repair man can reset them easily and absolutely reliably—however, outsiders may not do so; that is important to you.

a safety valve which can be tampered with is very dangerous indeed . . .

National of . . . california

a 40-page book — free of charge — offers you a wealth of regulator data; why not write for it TODAY.

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Versatile—Dependable

INCO-ROD "A" electrode fills a long-felt need.

It joins many combinations of dissimilar alloys.

Use INCO-ROD "A" electrode to weld mild steel to 304, for example. Or 405 to 304. Or Monel* nickel-copper alloy to 410. Or 347 to Inconel* nickel-chromium alloy.

With each combination, the weld is strong and ductile . . . of X-ray quality. Corrosion resistance and mechanical properties usually equal or exceed those of the base metal. What's more, operability is excellent in any position . . . spray type arc . . . good slag removal.

More than thirty such combinations have been welded successfully with INCO-ROD "A" electrode. Industry is trying many other combinations . . . both between and among ferritic and austenitic stainless steels, low alloy steels, mild steels, high nickel alloys, and other types of alloys.

Better than 90% of all such jobs can be handled with this one versatile, new electrode . . . INCO-ROD "A"... the one with the *green* flux coating.

For welding data on *proven* combinations between common alloys, write for 'Announcing INCO-ROD "A"'. . . a new Inco folder. Be sure, too, to ask about alloys *you* commonly join. New data, not yet published, is constantly coming in from the field.

The INTERNATIONAL NICKEL COMPANY, Inc.
67 Wall Street New York 5, N. Y.

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Four convenient sizes handily packed. INCO-ROD "A" electrode is supplied in 14-inch lengths in four diameters, 3/32", 1/8", 5/32" and 3/16-inch (the 3/32-inch is center grip) packed in 5-lb., tubular, asphalt-lined, protective containers (NEMA color coded).

INCO **Welding Products** • electrodes, wires, fluxes

Letters should be addressed to: The Editor, WELDING ENGINEER, 12 E. Grand Ave., Chicago 11, Ill. No letter will be published unless signed, but your name will be withheld if requested.

Data Sheets

Dear Sir:

WELDING ENGINEER and data sheets requested all arrived at the same time. Many thanks. They are really the berries. Have all the weldors getting into them and they are really doing good. Some of the articles are just what we have been wanting for a long time.

Howard L. Wells
Baltimore & Ohio R. R. Co.

Aluminum vs. Copper

Dear Sir:

The article in your December, 1955, issue by H. C. Rapp, "Copper vs. aluminum cable," is very well written for copper's side, but does not give the whole story.

The author, in his closing paragraph, qualifies his article by stating: "From the standpoint of efficient operation and service life, copper appears to be the preferred material for welding cable." This is not the standpoint taken by the welding operator who has been belabored for years with heavy, unwieldy copper cables.

He wants flexibility with minimum weight. An example is the wide use of electrically inefficient small whip cables on the end of heavy lead cable to the electrode holder—with resultant heating due to current damming effect of the too small whip cable.

The article giving aluminum's side (in your September, 1955 issue) made no claim that aluminum was a more efficient conductor than copper, or that aluminum would have longer life. The article brought out the fact that copper now had a competitor in lower cost, good supply, and that it was a satisfactory material for welding-cable usage.

The copper article neatly side-steps manipulative or manual flexibility. This is the one quality expected of a good welding cable. Where the same quality of conductor jacketing is used, aluminum excels copper stranding. The lesser

Atlas introduces a NEW Wood Grip

IT FITS THE HAND

Easier to Grip!

Safer!

PROVED PRACTICAL ATLAS WELDING ACCESSORIES

FAMOUS ATLAS "DUAL TOOLS"

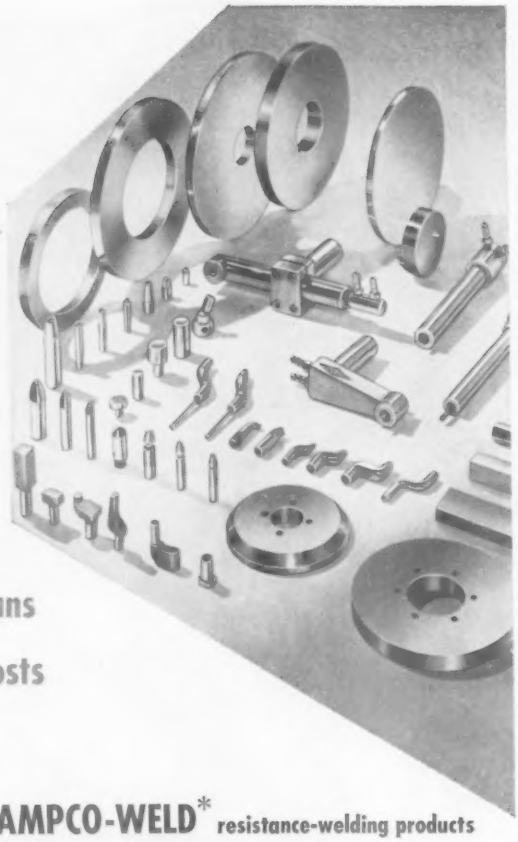
MODEL AW

MODEL B1W

JUST 2 OF 27 ATLAS MODELS

Ask your welding supply dealer to show you the complete Atlas line. Atlas "Tomahawks" and "Dual Tools" are constructed to outlast ordinary weld cleaning tools and actually cost less in the long run. Welders like their "feel" and balance, turn out more and better work with less fatigue.

ATLAS WELDING ACCESSORIES CO.
707 E. LEWISTON AVENUE, FERNDALE 20 (DETROIT) MICH.



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for longer runs and lower costs

...when you use AMPCO-WELD* resistance-welding products

Every item in the complete Ampco-Weld line is manufactured under strict laboratory control to give you longer runs and lower costs.

AMPCO-WELD spot-welding tips — stay cooler — won't stick to the work . . . tough — resist mushrooming and wear . . . fewer dressings needed — they last longer, cost less.

AMPCO-WELD rod — is available from stock — either in rounds, including hex, or in square and rectangular bars. There's a size for every need — all feature Ampco toughness and high electrical conductivity.

AMPCO-WELD seam-welding wheels — many users report 150% longer life. Resist wear — even at elevated temperatures. High electrical conductivity. Get them on short notice as rough forgings, finished blanks, or fully machined.

AMPCO-WELD resistance-welding holders — to suit every job — straight, offset, and universal ejector models. Offset and universal holders have interchangeable sockets for No. 1 and No. 2 Morse tapers. You change tapers without changing holders.

All Ampco-Weld resistance-welding products meet or exceed RWMA specifications. Experienced engineering service is also available. Get what it takes to lower your resistance-welding costs — get Ampco-Weld, the best value for your resistance-welding dollar.

RW-15

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Dept. WE-2
Main Office and Plant • Milwaukee 46, Wis.
West Coast Plant • Burbank, California

*Reg. U. S. Pat. Off.

Sole producer of genuine Ampco Metal

weight of aluminum enhances the feeling of flexibility and freedom of movement.

The matter of duty cycle (arc time) is given no consideration in the copper story. The heat retention of aluminum cable, even one or two sizes larger than copper, is of shorter duration when either material is carried to an overload condition.

Average to light-duty cycle work permitting use of equal or slightly larger than copper cables weighs definitely in aluminum's favor from the standpoint of manipulative flexibility, weight, human energy consumption and actual cost per foot—especially true where 2/0, 3/0 and 4/0 size cables are used on manual operations.

The copper story emphasizes the "bad" in the nature-provided protective coating of non-progressive oxide, inherent to all unsealed aluminum surfaces. It is true these need to be coped with at the time of making a cable joint or connection. But copper oxidation is actually corrosion in that it starts at the time of manufacture and is a continuous deterioration during the life of the cable.

An old copper cable will not carry the amperage of a new one of the same size which has not seen welding duty. The continuous oxidation of the copper stranding is borne out by the "corrosion dust" which can be shaken out of old used welding cable. Aluminum remains bright during its life and is unaffected by sulphur and other curing compounds used in welding jackets.

In the final analysis, the weldor is king. He is the highest cost factor in welding and the hardest to come by. Management will listen to his decision as to whether the lightness and flexibility of aluminum over copper makes his labors more productive and easily accomplished.

R. L. Townsend
Tweco Products Co.

—Mr. Townsend is author of the article on aluminum cable which appeared in our September, 1955, issue.

Requests tear sheets

Dear Sir:

The August welding clinic, "Advantages of the projection welding process," was of interest to us. Would it be possible to receive three copies of this article, together with the "Data Sheet No. 179: Projection welding design data."

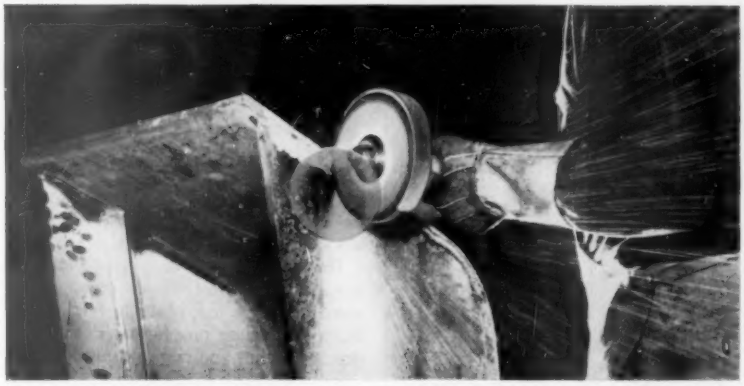
These articles would be useful in our welding operative training scheme.

A. H. Pratty
Girling Limited

—The articles have been sent to Mr. Pratty in England.

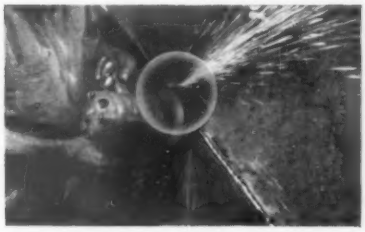
Do every grinding job with the "TOUCH of GOLD"

Norton BD Rigid Hub-Type Wheel smooths a flame-cut edge. This heavy-duty Norton Reinforced Wheel is also excellent for cutting-away, smoothing heavier welds, making V-cuts for removing old weld material, etc.



Norton Straight Wheel makes fast work of smoothing a heavy butt weld. This is a resinoid bonded wheel, made of ALUNDUM* abrasive, the toughest, strongest abrasive you can use.

Norton BFR Semi-Flexible Hub-Type Wheel smooths a welded radius. Strong, safe and versatile like all Norton Reinforced Wheels, the BFR is best for lighter weld grinding applications. Like the BD it notches, slots and cuts off.



Norton Flaring Cup Wheel grinds a weld on a fabricated structure. (Note rotating guard.) Built-in balance makes all Norton portable wheels *hug that work.*

Norton Cone Wheel smooths up a hard-to-get-at weld on a fabricated machine base. Easier handling on countless jobs like this means faster, more profitable work for *you.*

Norton BF Semi-Flexible Wheel blends a contour — on a stainless steel part for a piece of Pharmaceutical equipment — a material for which this lightest Norton Reinforced Wheel is especially suitable.

The Norton line of weld grinding wheels is 100% complete...100% top-performing

From your lightest scale removal to heaviest duty cutting-away there's a type and size of Norton wheel that will do the job faster, for less money, and produce better results.

Norton portable wheels include all standard solid types, as well as the increasingly popular reinforced types, especially engineered for maximum strength, safety and versatility. They're built to *hug that work*, with more continuous contact, less vibration and bounce. Which means less operator fatigue and more metal ground off per man-hour — additional "Touch of Gold" advantages that boost your profits!

Your Norton Distributor will gladly help you select the right wheels from this complete line.

Or write to NORTON COMPANY, Worcester 6, Mass. Distributors in all principal cities, listed under "Grinding Wheels" in your classified phone directory. Behr-Manning Corporation, Troy, N. Y., is a division of Norton Company. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Massachusetts.

W-1633

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*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

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SMITH'S Econoflo Regulators

This is a new line of popular priced regulators which give you what you want in accurate trouble-free gas flow control. Functional parts have been reduced by 25%. That means fewer parts to wear, so you get longer life with less maintenance and upkeep costs. The seats are practically indestructible. They resist wear, heat, pressure and corrosion.

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That means less wear, less maintenance, less time to adjust and operate. These Regulators are built to stay on the job. They let you forget about regulation and concentrate on your work. Special sintered bronze filter protects mechanism against wear from dirt and dust.

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All-welded houses

Dear Sir:

We have read with much interest the article "Lightweight steel plus welding equals low cost home," in the November WELDING ENGINEER.

We wonder if it would be possible to obtain more detailed plans and approximate costs of construction. We plan to use this data during class talks to our weldors.

Bob Kerr
Kerr Fabricators

Dear Sir:

I am planning to build a home soon, on a beautiful valley-view site near Portland, Ore. For a long time I have felt that welded steel construction would be economical and suitable for both low-cost and luxury housing.

The house described in your November issue seems to have just about overcome most of the obstacles. I would much appreciate any further details regarding it that you might furnish.

Harry S. Swan
Willamette Iron & Steel Co.

—Mr. Kerr and Mr. Swan have been advised to write the following firms for more information: Brooks Coddington, 329 E. Broad, Columbus, Ohio; Maxon Construction, Barrington, Ill.

Dear Sir:

The article "Lightweight steel plus welding equals low cost home," in your November, 1955, issue interested me because it dealt with building homes of the future out of lightweight steel.

I would like to know where I could obtain books or publications dealing with this new idea in home construction.

Don Lortz
Idaho Falls Sheet Metal Works

—Addresses of Penn Metal Co., New York City; Brooks Coddington, Columbus, Ohio, and Maxon Construction, Barrington, Ill., have been forwarded to Mr. Lortz.

"Our welder wears them according to the mood he's in."

Why "Do It Yourself"?

Standard MALLORY Electrodes *Cost Less, Weld Better*

Makeshift, "home made" welding electrodes can cost more than you realize. Not only do they take a lot of time to contrive, but they seldom have the strength, conductivity and cooling facilities to give good welds and satisfactory life.

Before you "do it yourself," take a look at what Mallory has to offer, in the way of unusual electrode shapes. Literally hundreds of single and double bend electrodes that you may consider special are standard Mallory designs . . . which we can make promptly and economically using existing tool facilities.

Exclusive Mallory cold-forming techniques shape these bent electrodes from full hard rod stock, and develop high hardness and strength far beyond what can be obtained by conventional hot forging methods. Cooling tubes may be bent in place* by a special process, to provide water flow as near to the welding face as in the case of straight electrodes. These extra values designed into Mallory electrodes assure you of long life, long runs between dressings . . . more welds per dollar.

For information on available designs, ask your local Mallory Welding Distributor for a copy of the latest Mallory Welding Catalog, or write directly to us.

*Patent Number 2489993

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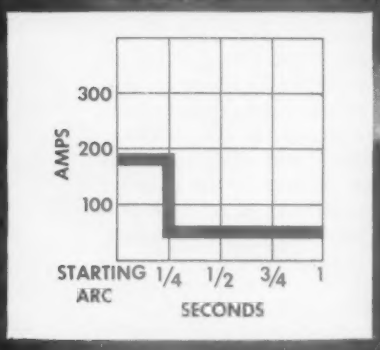
For information on titanium developments, contact Mallory-Sharon Titanium Corp., Niles, Ohio



NO FALSE STARTING, no ragged weld beginnings with the G-E a-c welder's hot-start. Automatic G-E hot-start gives an extra boost of current for ¼ second . . . assures instant arc striking and extra penetration at the start of the weld.

FOR ALL YOUR WELDING NEEDS . . . .

A FULL LINE OF G-E WELDERS AND ELECTRODES

G.E. offers all popular forms of arc welders—plus a complete line of electrodes and accessories. This means that G.E. can recommend the equipment best for your job, without favoring any one type.

G-E MOTOR-GENERATOR WELDERS, are available in 200- and 300-amp sets. They feature a unique interactor, which practically eliminates popouts and voltage fluctuations.

NEW 200-AMP engine-drive welder, field-proven on construction and job-shop work, gives steady output, even above full load.

No False Starts . . . No "Popouts" With New G-E Line of AC Welders

Arc strikes instantly, stays steady—gives a sound weld from start to finish

Any professional weldor knows that better welds and easier welding begin with a good arc.

General Electric's new line of a-c transformer welders gives you this good arc—instant-striking and steady—plus many other features that make your welding faster, easier, and more economical.

1. NO FALSE STARTS. G-E automatic hot start provides that necessary extra surge of current which assures you of instant arc striking. Besides saving time, the hot-start furnishes extra penetration at the start of the weld—and reduces sticking.

2. ARCS ARE EASIER TO HANDLE, too. Popouts are practically eliminated because G.E. has made the normally stable a-c arc even more stable by the addition of special capacitors. These capacitors provide the equivalent of 5 additional open-circuit volts.

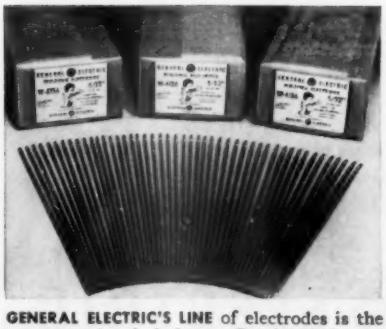
3. G.E.'s FINGER-TIP CONTROL gives you pinpoint accuracy of current with the moving-coil design. You don't have to "crank" the handle on a G-E welder to change current settings. It smoothly moves the primary coil on a finely-threaded, rubber-cushioned shaft—to give you stepless current control.

SEE FOR YOURSELF the operating advantages of the G-E a-c welder line. Ratings are available in 300-, 400-, and 500-amps . . . and 295 amps for general purpose welding. Just contact your nearby G-E Welding Distributor and ask for a demonstration. He's listed in the yellow pages of your phone book.

Progress Is Our Most Important Product

GENERAL ELECTRIC

A G-E EXCLUSIVE on the new 300- and 400-amp d-c rectifier welders is full-time arc-force control, which gives you a forceful, easy-to-handle arc.



GENERAL ELECTRIC'S LINE of electrodes is the most complete in industry. Special "balanced design" gives you a combination of: (1) Ease of use (2) X-ray quality (3) Welding speed.

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Section D, 711-3 General Electric Company, Schenectady 5, New York

Please send me the bulletins checked below:

- ☐ GEA-6243 G-E AC Welders
- ☐ GEA-6242 G-E Rectifier Welders
- ☐ GEC-664 G-E MG Welders
- ☐ GEC-1333 G-E 200-amp Engine-drive Welder
- ☐ GED-2584 G-E Electrode Catalog

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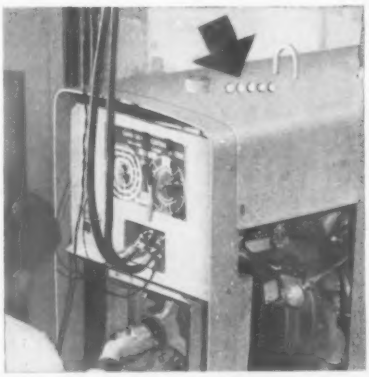
G.E.'S NEW ENGINE-DRIVE WELDER GIVES YOU . . .

Steady Welding Output—at Full Load; Improves Weld Quality, Costs Less Too

If you're using more than a 200-amp engine-drive welder for light to medium-heavy construction, you may be losing money. You may be paying for inefficiency—compensating for excessive loss of amperage and arc heat when operating at full load for sustained periods.

Now, with G.E.'s new 200-amp engine-drive welder, it's not necessary to buy more expensive, higher rated machines for pipeline, light construction, or job-shop work. This field-tested welder gives you steady output and 100% arc stability, hour-after-hour, even when operated *above* full load.

Test this powerful new welder yourself, and see the many advanced design features—new slow-down control, extra-rugged construction, and many others. Contact your nearby G-E Welding Distributor today. He's listed in the yellow pages of your phone book. Section 714-3, General Electric Co., Schenectady 5, New York.



EXTRA-STURDY construction is shown in this demonstration. Five nickels stand on edge while welder is operated at full load.

GENERAL ELECTRIC

YES we were 1ST in
1 High impact Tip Insulators to reduce maintenance costs.
2 Interchangeable Tip Insulators to reduce maintenance stock requirements.
3 High heat resistant Plastic Tip Insulators to withstand higher temperatures near welding arc assuring longer life.
4 Plastic Handles to prevent moisture absorption and warpage as well as insulate glove from Holder heat.
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6 Spring Adjustment Screw for ease of Rod release.

AND NOW....

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HI-AMP ELECTRODE HOLDERS

Visit our Booth 18 at Welding Show, Buffalo, May 9-11, 1956.

7 Wrap around Plastic Tip Insulation for maximum electrical insulation and heat resistance — 30% more than any other make.

8 Brilliant Red and Yellow Plastic Colors insures identification of Holder anywhere in plant — Valuable Safety Feature.

YES, WAGNER HI-AMP LEADS THE FIELD IN ELECTRODE HOLDER IMPROVEMENTS AND ADVANTAGES

Make your own comparison—using the 8 WAGNER HI-AMP advantages as your guide. You will never use any other Electrode Holder once you actually "see" and "feel" the difference.

Write for Descriptive Literature — Order Today.

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Weld with Wagner

8 reasons why production welding should be done with LINCOLN

IDEALARC

1. Choice of AC or DC welding current . . . whichever is best for your job. The ideal welder for production line operations.

2. Dual control gives soft arc and forceful, non-sticking arc . . . Idealarc gives you both, in AC and DC.

3. Easy Striking . . . Lincoln Arc Booster gives easy striking for both AC and DC to assure positive arc starting.

4. Steady arc that is easiest to hold with any electrode in any position, AC and DC.

5. Dependable operation under the heaviest loads... with complete overload protection against burnout.

6. Simplest Installation . . . operates on single phase power.

7. Available as a straight AC welder to which DC can be added at any time.

AND THE BEST REASON OF ALL

8. LOWER COST PER WELD through faster AC and DC welding with Lincoln's new iron-powder electrodes:

JETWELD 1 for welding flat and horizontal fillets.

JETWELD 2 for welding flat, deep grooves and horizontal fillets.

JETWELD 2HT for welding flat position, deep groove joints and fillets in low-alloy, high tensile steels.

"Improved" **FLEETWELD 47** for fast, smooth, all-position welding.

Hadn't you better check LINCOLN now?

Have Lincoln's factory-trained specialist show you how IDEALARC and these new Lincoln electrodes will give you better production, lower costs. Write for Bulletin 1343.

THE LINCOLN ELECTRIC COMPANY

Dept. 1712, Cleveland 17, Ohio

The World's Largest Manufacturer of Arc Welding Equipment

FEBRUARY, 1956

Welding Engineer

ESTABLISHED 1916

Keep pace with progress

In the 40th Anniversary issue of Welding Engineer last month, many readers expressed serious thoughts on the future of our great industry. They placed particular emphasis on the growth of automatic welding and on the ways in which automation would spread through all welding processes. Many felt that this was the only way industrial America would be able to keep pace with consumer demands.

Our economists tell us that, by 1975, our gross national product will be around $850 billion a year—more than twice what it is now. At present, there are more people working than at any time in our history . . . more goods being produced . . . more welding being done.

In the midst of our greatest production program, some labor leaders and fuzzy-thinking politicians have been telling us we will have to reduce the work week. They are advocating a four-day, 32-hour week.

When the shorter week, lower retirement age, minimum wage hike and a guaranteed annual wage are recommended, it must be remembered that all of them raise labor costs. Increasing labor costs naturally lead to the introduction of other labor-saving devices.

It is strange how the very thought of labor-saving machines and techniques implants fear in people's minds. Of course, there is some natural dislocation when automatic processes are introduced. The necessary reappraisal of certain jobs and the changes in employee job habits and attitudes thus effected can best be seen in the automotive field and in large offices. These are areas where the use of automated devices was quickly found to be economically advantageous. Yet there has not been any decrease in employment.

Automation has made its greatest advances, so far as welding is concerned, in the uses of resistance welding processes. In this field of welding, as in so many fields of automatic operation, the speed with which industry can approach full automation is limited.

We do not have sufficient capacity to produce all the resistance welding equipment needed in this country. As is the case with all automatic equipment, there is a need for greater standardization of components, cost reduction, improved adaptability and plain ingenuity.

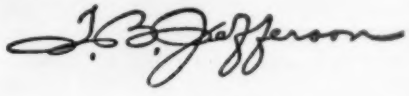
Our great concern should be not so much the effect that automation will have on industry, but how we are going to get enough workers to produce products we will need in the future. For example, if within 20 years we *do* reach a gross national product of $850 billion and if we want our standard of living to continue to rise at the rate set in the past 15 years, we will need to have a working force of *84 million workers.*

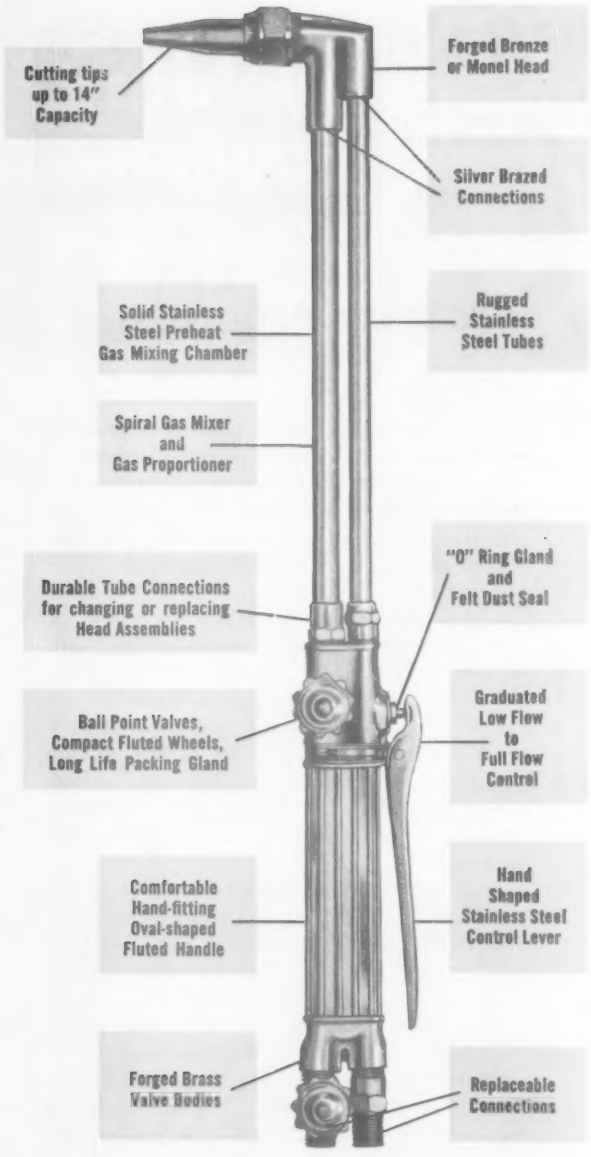
Each individual in this group would be expected to produce over $10,000 worth of goods annually—a quota that would be literally impossible to meet unless we were still working a 40 hour week.

In the welding industry, fear of automation has largely disappeared. Workers realize that automatic welding does not mean diminished employment. Maybe the weldor is shifted from a hand welding to an automatic welding job, but he is still kept busy. In the early days of welding there were those who thought arc welding would replace gas welding. Producers of gas welding equipment are selling more of their equipment today than they have ever sold.

In our growing economy, we are finding many additional uses for improved processes. That will continue to be the case.

Let's stay ahead of the changes in welding by doing our utmost to meet consumer demands. And this demand, of course, must be maintained by selling the advantages of our magic material joining processes and their companion processes for ease in severing metals.




Cutting tips up to 14" Capacity
Forged Bronze or Monel Head
Silver Brazed Connections
Solid Stainless Steel Preheat Gas Mixing Chamber
Rugged Stainless Steel Tubes
Spiral Gas Mixer and Gas Proportioner
"O" Ring Gland and Felt Dust Seal
Durable Tube Connections for changing or replacing Head Assemblies
Graduated Low Flow to Full Flow Control
Ball Point Valves, Compact Fluted Wheels, Long Life Packing Gland
Hand Shaped Stainless Steel Control Lever
Comfortable Hand-fitting Oval-shaped Fluted Handle
Forged Brass Valve Bodies
Replaceable Connections

VICTOR CUTTING TORCHES

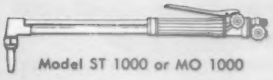
Try this torch on your toughest cutting job . . . you'll find it keeps a cool head . . . time tested Victor spiral mixer and gas proportioner assures safe, economical operation.

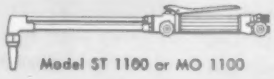
Note clean lines . . . try its comfortable balance and hand-fitting handle . . . quality construction assures trouble-free performance and ease of repair and replacement of damaged parts.

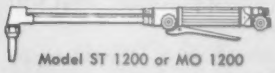
Choice of Monel (MO) or bronze (ST) heads . . . four control lever positions to suit every operator preference and job need. Four lengths: 21", 27", 36" and 48", available with 90°, 75°, 45° (ST Models only) or 180° angle heads.

Why experiment? Ask your Victor dealer to demonstrate this field-tested, operator approved torch on your hottest, toughest cutting job. Call him NOW.

FOUR LEVER POSITIONS


Model ST 1000 or MO 1000


Model ST 1100 or MO 1100


Model ST 1200 or MO 1200

Model ST 1300 or MO 1300

For maximum efficiency and safety use genuine Victor tips and parts.

Listed by Underwriters Laboratories, Inc.

VICTOR for welding

VICTOR EQUIPMENT COMPANY

Mfrs. of welding & cutting equipment; hardfacing rods, blasting nozzles; cobalt & tungsten castings; straightline and shape cutting machines.

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29

A job shop tries a new process and finds that . . .

Arc-cutting and gouging speeds oil drill repairs

AN UNUSUAL new procedure for reworking worn hole openers used in drilling oil wells has been instituted by Gosnell's Welding Shop, New Iberia, La. This new procedure is based on a patented metal cutting and gouging process, using only an electric arc and compressed air fed through a torch.

The jet of compressed air is automatically directed at the point of arc no matter what position the torch assumes, and continually blows away molten metal before it can harden into troublesome slag.

Three angular cutters and three side rollers are located on the periphery of a hole-opener body. When these cutters and rollers become dull and fall below gage, they are removed and new ones are installed. The body of the hole opener has an almost unlimited life.

Each set of cutters and rollers require four separate gouges and one cutting operation. At one time, slag or scale frequently deflected the cutting oxygen stream, and control of the cut usually was lost. With the new process, all this material is liquified and blown free along with the base metal.

Before the Gosnell shop adopted the gouging and cutting process, four hours of cutting were required to remove worn cutters and rollers. It then required a half hour of grinding to prepare the body for welding. One 300 cu ft cylinder of oxygen and 150 cu ft of acetylene were consumed in the old method.

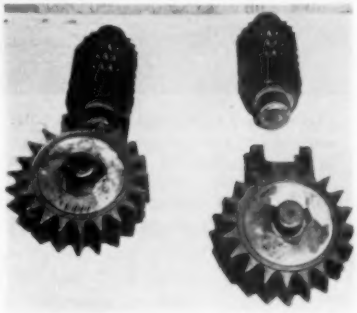
Using the new procedure, removal of the same parts is accomplished in 1½ hours. An average of 18¼ in. of carbon-graphite electrodes are consumed. No grinding is necessary to prepare the body for subsequent welding because the arc cuts and gouges are clean.

Not only did the new process result in a better finished job at a marked reduction in shop labor time, but electrodes proved more economical than oxyacetylene, giving actual material cost savings as well.

Mr. Gosnell stated that "the process paid for itself in thirty days and delivered a better finished job."

—Photos courtesy Arcair Co.

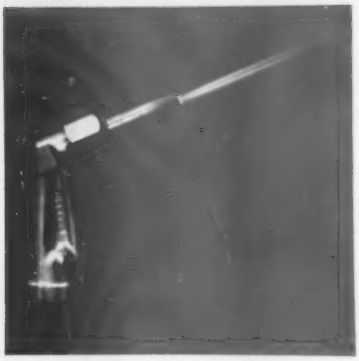
DISPLAYING a well opener ready for welding are Miles Gosnell (right), owner of the shop, and weldor Robert Andre. Chalked letters indicate four gouged areas. Cuts are clean; no grinding has been done.



THESE are the new cutters and rollers that will be welded to the rebuilt hole opener body, replacing below-gage parts.

OPERATOR uses carbon-graphite electrode to gouge an area comparable to that marked with chalk at bottom center of picture.

CHIPPED and dulled cutters and rollers will be cut from this hole opener body in 1½ hours, instead of 4 hours needed with old method.



TOP—Hard oxypropane flame with cutting oxygen stream on gives high preheat quality.

BOTTOM—Oxypropane soft flame —with oxygen on—gives decreased preheat quality.

Propane vs. Acetylene:

Comparative testing oxypropane cutting

BY JAY BLAND*

THE USE of propane as a fuel gas in the oxygen cutting of steel frequently has been the subject of considerable discussion and argument. Proponents of oxypropane cutting have argued that this method is more economical than oxyacetylene cutting.

They also point out that oxypropane-cut edges have better appearance than do edges cut by oxyacetylene. Opponents of oxypropane cutting argue that this method is slower than oxyacetylene cutting, and possible savings in gas costs are offset by increased labor charges.

In order to establish a factual basis for evaluation of oxypropane cutting of steel, the Engineering Research Dept. of Standard Oil Co. (Indiana) conducted a limited study of one modern oxypropane cutting torch.

*The author is head of the Metals Section, Engineering Research Dept., Standard Oil Co. (Indiana), Whiting.

Any petroleum refiner, of course, has an economic interest in the use of propane, one of the products made in most refineries. This interest applies not only to internal use of propane, but to the possible sale of propane as a fuel gas in oxygen cutting of steel.

No refinery, on the other hand, will promote oxypropane cutting unless definite economies are evident.

Materials and Procedure

Manual oxypropane cutting tests on new and rusted steel plates were made with a hand torch. Machine cutting tests were made with a machine torch body mounted on a commercial carriage. A complete set of oxypropane cutting tips, sizes 00 to 5, was tested.

Propane used in most of these tests was bottled at the Whiting refinery of Standard Oil. Tests at other refineries used propane taken either from an LP cylinder or from a plant line. Gas flow rates were obtained from calibrated flowmeters.

Oxypropane tips used created a converging cone of flames and produced a wide range of preheat quality. This was accomplished by varying the amount of preheat oxygen and adjusting for a neutral flame. Although propane is aspirated into the tip by oxygen flow, some adjustment at the fuel gas valve is possible, permitting a neutral flame.

A *hard* flame provides maximum preheat quality, which would be needed for piercing or for cutting heavily rusted or scaled scrap.

A *soft* flame is ideal for machine cutting operations which usually involve clean materials. The cutting oxygen stream through a soft flame is longer than through a hard flame. This permits cutting heavy plate more uniformly with a soft flame. Preheat quality of a soft flame is adequate for any machine cutting operation.

Machine Cutting

Table I lists some data for machine cutting with both oxypropane and oxyacetylene tips. An attempt was made to hold speeds constant for each plate thickness for both fuel gases. In view of the difference in oxygen orifice size, however, this was impossible.

Results indicate that preheat time is about the same for the new oxypropane tip and the standard oxyacetylene tip. The measured preheat time, 0.03 minutes, actually represents the time between flame positioning and starting the machine carriage.

In all cases, this slight delay permitted both oxypropane and oxyacetylene tips to start their cuts.

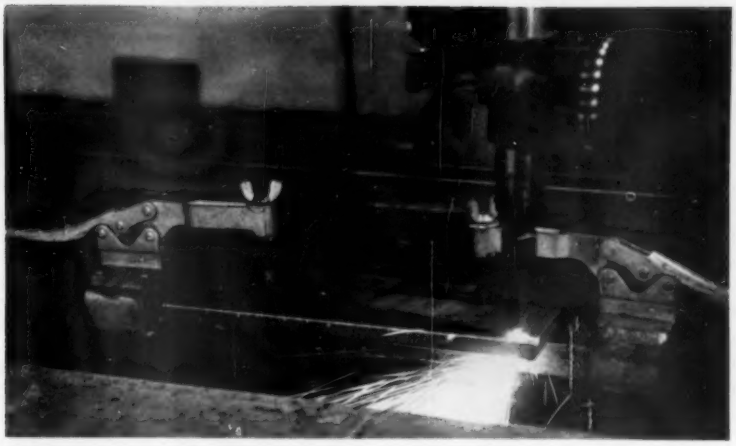
Flow rates measured for both propane and acetylene were so low that accurate readings could not be obtained with the flowmeter on hand. It was estimated that gas flows of between 8 and 15 cu ft per hour were used for tests cited in Table I.

Comparable Cutting Speeds

Data from other sources indicate that quantities of acetylene larger than those of propane were required for equivalent cutting operations. Flow rates for oxygen include both that required for preheat flame and for the cutting stream.

For comparable oxygen orifices, oxygen consumption is equal. In cutting 2⅞-in. plate, orifice sizes are about the same, but more oxygen was used in acetylene cutting than in

confirms value



MACHINE application of oxypropane cutting torch is made on ½ in. steel plate.

propane cutting.

Cutting speeds, in general, were about the same, although the propane tip permitted slightly higher speeds in the ½ to 1-in.-thick steel range. Speed of acetylene cutting was slightly faster than propane on 2⅞-in. plate.

On plate thicknesses over ½ in., acetylene caused more pronounced melting of the top edge. Propane cuts generally exhibited a smoother appearance with less scale thickness.

Hand cutting tests indicated that any work done with the oxyacetylene tip could readily be duplicated with an oxypropane tip. These tests included shaped or irregular cuts, cutting on scaled and rusted plate, and hole-piercing.

The oxypropane tip showed less tendency to lose a cut and greater ability to restart a lost cut. This comparison may not be too significant, however, because different operators can produce varying results in hand cutting.

Hole-piercing times were roughly equal, with a slight edge going to the oxypropane tip. This time factor is also a variable, since an operator who prematurely opens the oxygen valve will cool the spot and delay preheating.

Hardness of Cut Surfaces

Hardness tests indicated only that there is little difference in hardness of cut surfaces for either propane or acetylene. The differences noted in Table II are Rockwell hardness values for thin surface layers, and results of the deeper indentation of the Brinell hardness test.

Limited tests of new oxypropane cutting tips achieved slightly better results than those obtained with standard oxyacetylene tips. No difficulties were experienced, and oxypropane tips did not easily become clogged with spatter. These results were confirmed by tests made at Standard's Neodesha and Sugar Creek refineries.

Wood River refinery has been using propane for all cutting work; it has torches with standard oxypropane tips. Tests at Wood River with properly designed oxypropane tips indicated faster preheat and piercing times than were obtained with standard oxypropane tips.

All of these tests particularly emphasized the better appearance of an oxypropane cut, with no apparent loss in efficiency or increase in preheat time to start cuts or to pierce. Tests are underway to check other makes of oxypropane cutting tips for comparison with the tip discussed here.

Use of Propane for Cutting

There are several advantages in terms of safety and economy to be gained from the use of propane for cutting operations.

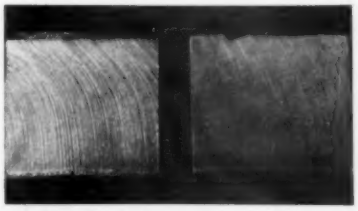
The new oxypropane tip operates at low pressures. The 2 psi value listed in Table I actually represents the first reading above zero on the regulator. A slight cracking of the regulator outlet stage valve is adequate for these tips, since design of the torch and tips is such that propane is sucked out of the gas line by the preheat oxygen stream.

As a result, accidental severing of a gas hose cannot release copious quantities of the gas, compared with acetylene lines which operate at pressures of 5 to 10 psi.

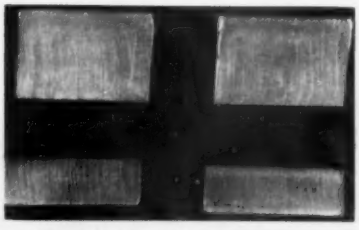
In view of reduced line pressures, there is less chance for a propane backfire to work back to the gas cylinder. Furthermore, flammability limits for propane are narrower than for acetylene (see Table III), and its ignition temperature is higher.

A propane cylinder equal in size to one of acetylene will contain roughly 8 times more fuel gas. This solves a handling problem and decreases the possibility of moving accidents. Less frequent cylinder changes also mean a distinct saving in lost time during changes.

Propane cylinders, used at lower



COMPARISON of oxyacetylene cut in 2⅞-in. steel (left), and oxypropane cut (right). Both cuts have been cleaned.



ACETYLENE and oxypropane cuts in ½ and 1 in. steel plate after cleaning. Propane cuts at left, acetylene cuts at right.

pressures, have thinner walls than their acetylene counterparts and consequently weigh less.

A single propane cylinder could handle the work which now requires a manifold system of eight acetylene cylinders of equal size. Any existing pipe distribution system for acetylene will also handle propane. In larger installations, small propane tanks obviously could replace a large number of acetylene cylinders. The only way to get greater acetylene volumes, other than from a large number of manifolded cylinders, is through an acetylene generator.

Economic Advantages

Gas costs for propane on the open market are less than those for acetylene, considering only cylinder supplies. Acetylene costs approximately $2.62 per 100 cu ft. (one cylinder); the price is about the same regardless of the number of cylinders purchased at one time. Actually, only about 90 to 95 cu ft of acetylene would be available from a 100 cu ft cylinder since it cannot be drained completely.

Propane in the same cylinder size (about 800 cu ft) costs about $11.35, or about $1.42 per 100 cu ft. In bulk quantities, the cost of propane will be much less.

Cost of a new torch (manual or machine) can readily be offset in gas savings. In those instances where only tip replacements are required, immediate savings will be evident.

Refineries or other plants set up for oxypropane cutting may find other uses for the gas, including preheating and welding. Propane is being used for preheating at Standard's Whiting refinery and, occasionally, in other refineries where it is available.

Propane heating is faster than acetylene heating in view of the greater Btu content of propane gas (2,572 Btu per cu ft for propane; 1,491 Btu per cu ft for acetylene). Lower flame temperature for propane (about 4,500 F) compared with acetylene (about 6,500 F), means less local overheating, burning or melting. Refinery gases often are being used for preheat, but they require longer heating times with higher labor costs than needed for propane.

Some Additional Uses

Propane also can be used in place of acetylene for many brazing and braze-welding jobs. Welding on nonferrous materials, particularly aluminum and copper base alloys, can readily be done with propane torches.

Welding steel with propane would be slower than with acetylene, but for plate thicknesses up to about ¼ in., or for pipe up to about 3 in. in diameter, differences in time would be minor.

Conversion to propane for these operations would require propane welding torches. However, for most operations, a combination welding and cutting torch would be preferred.

TABLE 1

MACHINE CUTTING TESTS

Oxy-propane tip No.	Oxygen orifice drill size	Plate thickness (in.)	Propane Pressure (psi)	Propane Flow (cfh)	Oxygen Pressure (psi)	Oxygen Flow (2) (cfh)	Preheat time (min.)	Cutting speed (ipm)
0	60	¼	2	(1)	30	67	0.03	26
1	56	½	2	(1)	30	91	0.03	24
2	51	¾	2	(1)	30	134	0.03	18
3	45	1	2	(1)	26	138	0.03	16
3	45	2⅞	2	(1)	40	237	0.03	10

Oxy-acetylene tip No.	Oxygen orifice drill size	Plate thickness (in.)	Acetylene Pressure (psi)	Acetylene Flow (cfh)	Oxygen Pressure (psi)	Oxygen Flow (2) (cfh)	Preheat time (min.)	Cutting speed (ipm)
4	60	¼	3	(1)	30	70	0.03	26
6	53	½	3	(1)	30	135	0.03	20
6	53	¾	3	(1)	30	135	0.03	16
6	53	1	3	(1)	35	147	0.03	14
8	46	2⅞	5	(1)	40	250	0.03	11

Note: (1) Flow rates between 8 and 15 cu ft per hour; readings on flowmeter were inaccurate in this range.
(2) Includes both preheat and cutting oxygen.

TABLE II

HARDNESS OF CUT SURFACES(1)

Gas Used	Plate thickness (in.)	Rockwell hardness B Scale	Brinell hardness (2)
Propane	½	88-96	126
	1	94	149
	2⅞	90	143
Acetylene	½	84-94	131
	1	93	156
	2⅞	94	143

Note: (1) Parent metal hardness about Rockwell B63, equivalent to Brinell 112.
(2) Actual readings. These are not converted from Rockwell values.

TABLE III

DATA ON FUEL GASES

	Percent of Fuel Gas In Air Low	In Air High	In Oxygen Low	In Oxygen High
Limits of Flammability (1)				
Propane	2.4	9.5	2.4	57
Acetylene	2.9	65	2.8	93
Ignition Temperature (2)	In Air		In Oxygen	
Propane	986F		986F	
Acetylene	804F		802F	

Note: (1) Data from Bureau of Mines Bulletin 503.
(2) Data from Marks Handbook, 3rd edition.

BRAKE rim is joined to face in a single pass by submerged-arc welder. Fixture rotates part.
—Photos courtesy Linde Air Products Co.

Oil rigs made stronger by Mig, Submerged-arc

POWER winches used in oil well rigs are called upon to handle tremendous tonnage. An average unit may daily raise, hold and lower strings of drill pipe up to 10,000 ft in length, and weighing over 100 tons.

Keeping pace with demands made upon equipment by the petroleum industry today calls for materials and methods of fabrication which turn out a constantly improved product faster, and at lower cost.

Two electric welding processes, submerged-arc and Mig (metal inert-gas) welding, are helping Cardwell Manufacturing Co., Wichita, Kan., do just this. The two welding processes are used to fabricate component parts for winches and drill masts.

Cardwell is one of the oldest manufacturers of oil drilling and servicing equipment. Making major changes as early as 1938, it was the first company in the mid-continent area to make submerged-arc welding a standard production method.

Mechanized Welding

A typical operation is the submerged-arc welding which reinforces tubular masts. A total of eight longitudinal welds, 10 to 20 ft in length, are required to join sections of this unit.

Previously, it took 6 to 8 hours to straighten out distortion resulting from welding. Good submerged-arc welds reduced the time required for distortion relief to approximately 2 hours, and doubled the welding speed of former methods.

Submerged-arc welding is used also in fabricating winch brake drums, bearing cases and cable drums which, in turn, are used in draw works, cable tool rigs and servicing hoists. In each of these operations, submerged-arc welding machines have increased speeds while producing welds of the highest quality.

A 1¼-in.-thick brake rim is joined to a 1-in.-thick face in a single pass at an average welding speed of 12 in. per minute. Another example of increased production speed is found in the operation where a 1⅛-in.-thick cable drum tube is welded to a 2¼-in.-thick hub.

Seven or eight passes are made on this application at an average speed of 10 ipm. This is more than four times faster than previously used hand welding methods.

Weldors Tested

At Cardwell, all weldors working on super-stressed alloy steels must pass certified AWS tests. Periodically, work samples are torsion and tensile tested to insure highest possible weld quality.

Mig welding, using an argon shield, is used to weld gussets in drum ends. This process has effected an almost 100% increase in arc time by eliminating the need for electrode changes.

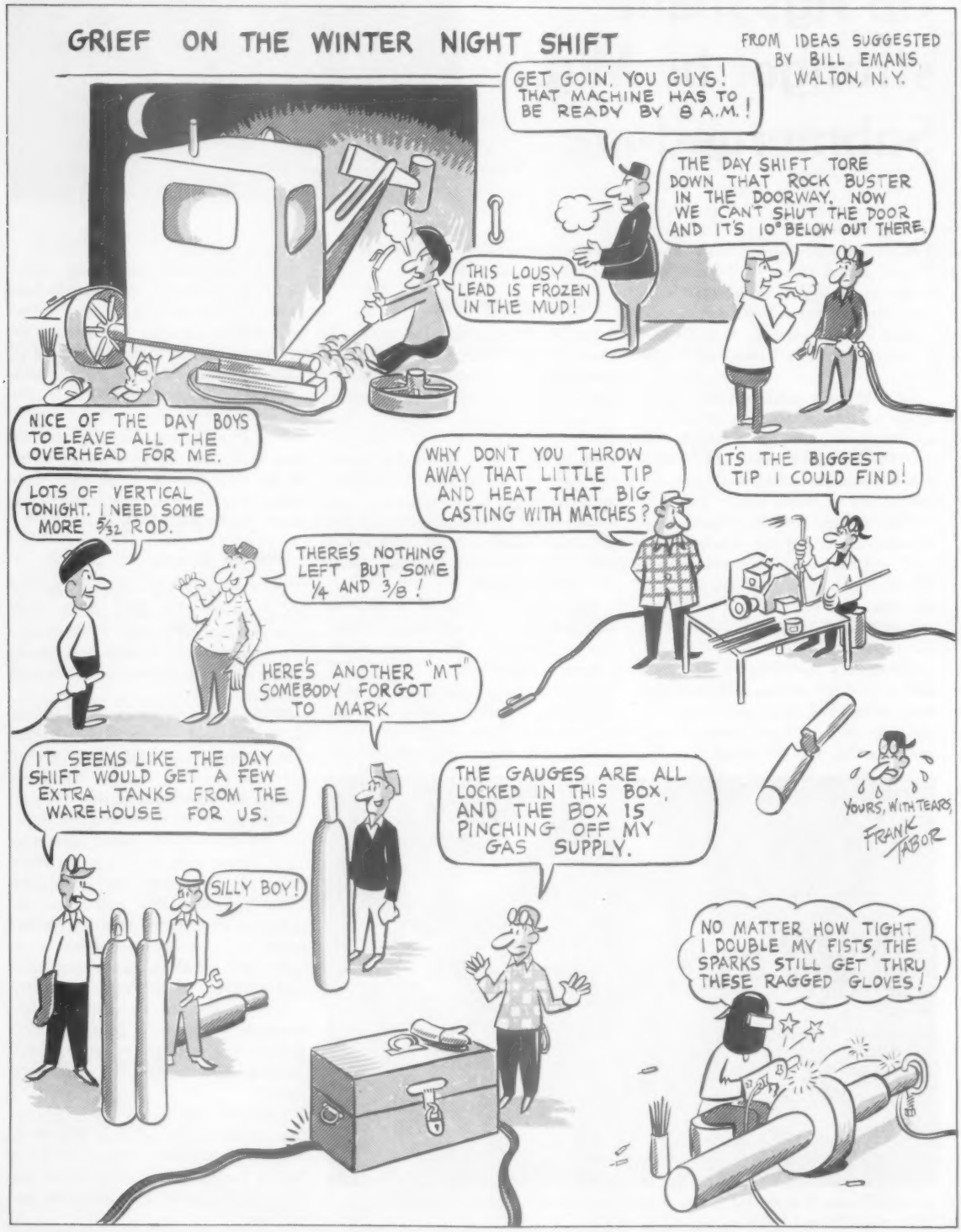
Operations are fast: average welding speed in joining ⅝-in. gussets to ⅞-in. drum ends is 15 ipm. In addition, Mig welding has practically eliminated distortion and parts require no cleaning or post-weld treatment.

In each of these operations, ease and efficiency of the work is greatly aided by the use of electronically-controlled, hydraulic fixtures which hold parts at any desired angle. These fixtures also rotate at adjustable speeds.

Cardwell has found the combination of submerged-arc and Mig welding with automatic fixtures to be a highly successful and economical one through five years of continuous operation.

GUSSETS are Mig welded to drum end. This process has increased firm's arc time an estimated 100%.

A WELDOR'S WOES


GRIEF ON THE WINTER NIGHT SHIFT
FROM IDEAS SUGGESTED BY BILL EMANS WALTON, N.Y.
GET GOIN', YOU GUYS! THAT MACHINE HAS TO BE READY BY 8 A.M.!
THE DAY SHIFT TORE DOWN THAT ROCK BUSTER IN THE DOORWAY. NOW WE CAN'T SHUT THE DOOR AND IT'S 10° BELOW OUT THERE.
THIS LOUSY LEAD IS FROZEN IN THE MUD!
NICE OF THE DAY BOYS TO LEAVE ALL THE OVERHEAD FOR ME.
LOTS OF VERTICAL TONIGHT. I NEED SOME MORE 5/32 ROD.
THERE'S NOTHING LEFT BUT SOME 1/4 AND 3/8!
WHY DON'T YOU THROW AWAY THAT LITTLE TIP AND HEAT THAT BIG CASTING WITH MATCHES?
IT'S THE BIGGEST TIP I COULD FIND!
HERE'S ANOTHER "MT" SOMEBODY FORGOT TO MARK
IT SEEMS LIKE THE DAY SHIFT WOULD GET A FEW EXTRA TANKS FROM THE WAREHOUSE FOR US.
SILLY BOY!
THE GAUGES ARE ALL LOCKED IN THIS BOX, AND THE BOX IS PINCHING OFF MY GAS SUPPLY.
NO MATTER HOW TIGHT I DOUBLE MY FISTS, THE SPARKS STILL GET THRU THESE RAGGED GLOVES!
YOURS, WITH TEARS, FRANK TABOR

A travelin' man gives . . .

On-the-job tests for pipe weldors

BY JACK FAIRLIE

MAINTAINING high quality, top performance field welding and brazing standards for the National Certified Pipe Welding Bureau in Illinois is an all-too-brief definition of work performed daily by consulting engineer William Lilly.

Lilly is one of many NCPWB representatives throughout the country whose job it is to administer qualification tests required by Section IX of the ASME Boiler and Pressure Vessel Code.

Traveling about in a station wagon fitted with oxygen and acetylene tanks, a semi-automatic flame-cutter and a guided bend tester, he is fully equipped to test and evaluate any pipe weld on the spot.

Tests are given on a job site with the full cooperation of welding contractors who are NCPWB members. A pipe weldor must be tested at three-year intervals (an ASME provision); or if he has not performed work for which he is qualified within a three-month period, or if a supervisor finds a consistently serious fault in his work.

Complete member roles, supplied monthly by member contractors, are maintained in Lilly's Chicago office. This city, incidentally, was the first to establish an NCPWB chapter. Drawing upon these records, the NCPWB representative informs contractors of *(a)* the qualification status of welding job applicants; *(b)* tests scheduled for weldors already on the job, and *(c)* test results.

Lilly also keeps in touch with weldors, informing them a month in advance of proposed test dates.

Contractor Specifies Test

The actual test—or group of tests—to be given is specified by the contractor. These tests may require weldor qualification under any one of approximately 14 specifications, covering all alloys used in pipe fabrication.

Weldors unacquainted with basic fundamentals of electricity may draw a low score, or, at best, a sound warning to improve their job knowledge. Operators who can perform well only when using a favorite welding machine or electrode type will find themselves in the same boat. Lilly constantly stresses the advantages of, and the need for weldor versatility.

Weld appearance also rates high on the NCPWB qualification program, and here, as in all other areas, Lilly is the first to give time-proven tips to aid improvement.

Flame-cutting a longitudinal strip from a test-welded pipe segment, Lilly can side-bend the metal and offer an accurate judgment in a matter of minutes. If acetylene welds are to be tested, Lilly simply carries his testing procedure one step further and puts one pipe strip in the bending machine and another in a tensile pull unit.

75% Qualify

Lilly estimates that, of all weldors tested, approximately 75% qualify under NCPWB standards. Whether those who fail receive a second opportunity to pass their test is for Lilly and the contractor-employer to decide. This decision, naturally, is influenced by such factors as the weldor's lack of recent practice, his attitudes, habits or general physical condition.

The vast improvement in welding processes and techniques has not, Lilly sadly notes, been accompanied by a corresponding increase in weldor knowledge and ability. As he makes his rounds, Lilly must still combat the bad affects of what he terms the "word-of-mouth" welding school.

Graduates of this "school" (and they are not restricted to the work shop alone) still resist new methods which have been proved safer, more productive and more economical.

Until this class has been replaced by weldors who are willing to learn and keep pace with new developments that mean safer products, men like Bill Lilly will continue their watch for the imperfect and strive to create a better welded fabrication.

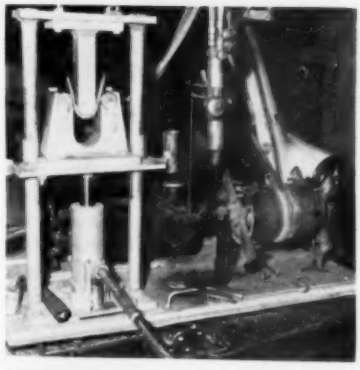
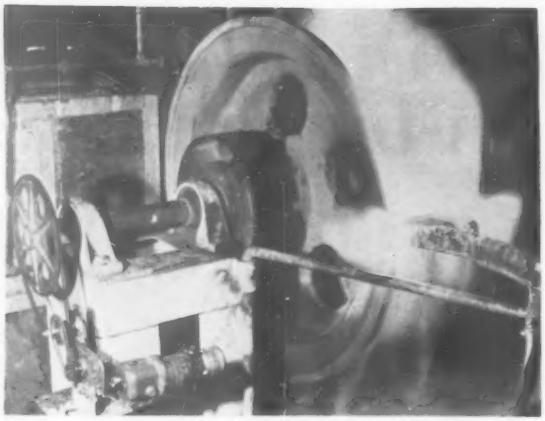


PHOTO sequence shows weldor beginning circumferential pipe welding test (top); NCPWB representative Lilly flame-cutting test strip in back of station wagon (center) preparatory to making side-bend test (bottom). Weldor in this case passed test.



CONTOURED head is used on torch to flame-harden a large sheave mounted on turning wheel.

INNER wall of coal pulverizer is flame-hardened. Ductile iron composition of pulverizer is well suited to receive the heat treatment.

Big problems are commonplace in flame-treating oil industry tools

BY R. F. ARNOLDY*

SPECIALIZED maintenance, in the context of this article, indicates shop work in the manufacturing or heat treating of metals for the petrochemical industry.

The problems found in that industry literally "throw the book" at the metallurgist and the weldor, who must work with solids, liquids and gases under all combinations of corrosion, abrasion and heat, with a special added complication—pressure. In producing or maintaining equipment for such conditions of service, acetylene processes have been a great help.

In describing the use of these processes, conventional welding, cutting and brazing operations will be passed over in favor of those less frequently used at Texas Alloy Products Co.

One very useful application of acetylene is the wash-grooving or removal of non-cuttable metals. Use of standard torch tips or gouging nozzles enable defect removal, weld preparation or area removal of welded-on coatings. Appropriate choice of nozzles or tips gives very smooth surfaces on many types of metals. Air is sometimes used to blow away fused metal.

Gas Healing Ceramics

Another use of acetylene is in the healing of certain ceramic coatings. Where welding has been done, or where a bare spot has been left over a support in fusing, this operation can be performed on the thin-coated ceramics developed for protection of stainless steels against hot gas oxidation. In most cases, 100% coverage is thus made possible.

In machinery or process equipment it is often necessary to remove a part held by a shrink-fit. Bushings are removed from heavy chain links by heating the bushing internally to about 1,700 F. This causes an expansion upset of the bushing, and on cooling it can be removed with a hammer and punch.

Press removal without heating the bushing requires over 150 tons of pressure. The heating method is often used, also, to decrease the bore of parts made with expensive materials, or those which would be difficult to re-make.

A familiar use of the expansion-upset principle is in flame-straightening, particularly on plates and members in shipbuilding. Weldments at Texas Alloy are straightened in a similar manner.

After some investigation, it was found that parts made of, or surfaced with hard, brittle material could also be straightened within limits by the application of lower orders of pressure and gentle torch heating.

Pressure Welds

Another adaptation of the same principle is used in straightening cylindrical parts which have been hard-faced with brittle metal. Also, where shafts or rods with collars are to be produced, this method is used with an assist from a press where required.

By means of the press and acetylene welding heads, pressure welds

*President, Texas Alloy Products Co., Houston, Texas. This article is based on a paper given by the author at a meeting of the International Acetylene Association.

are produced. Our work has included butt welding up to and including 5-in.-diameter SAE 1020 bars. We regard this as a near-perfect form of welding and most desirable for end joining, particularly of heavier sections.

One standard operation is the torch application of machine-quality hardfacings which must be completely free of holes or checks. Alloys applied in this manner include cobalt and nickel-base types. The latter alloy type also finds wide use in a sprayed or welded application on mechanical parts.

An acetylene process of particular importance is flame-hardening. This includes flame-strengthening and an application termed flame-cathodizing.

Basically, flame-hardening involves heating to a limited depth with acetylene flames, followed by a quench. Methods used are progressive (in a path), spinning (on the periphery of a rotating part), and combination (the rotating and traversing of a cylindrical piece).

Two machines which were constructed for combination-type hardening work use external hardening equipment and bore-hardening equipment interchangeably. One was set up for bore hardening, and the other for external hardening as a means of minimizing set-up time.

Evolution of Design

Considerable evolution occurred in the design of internal hardening heads over a period of several years. The latest design leaves the central gas-supply post fixed in the machine while head changing is done by the removal of one nut at the bottom.

Each head covers a range of diameters in ½ in. increments. Bores hardened by this machine range from 2 to 9 in. in diameter and up to 36 in. in length. Many thousands of liners have been hardened with this arrangement.

Another machine, used only on external work, is also constructed to take bore-hardening equipment. This is a floor-level machine to facilitate handling of work.

A series of 12 independent heads are radially adjustable to process work from ½ to 6 in. in diameter. Each head has its own torch, and is individually adjustable for flame quality.

Both machines have hydraulically operated travel with mechanical rotation. Accurate travel speeds are obtained by use of a flow meter in the cylinder outlet line. One machine has been set up for automatic lighting and gas. Electromechanical limit stops are adjustable for any hardened length desired. Pyrometer mounting has been used where close temperature control was needed.

Carriage Travel Problem

The two-post system would give accurate alignment in these machines, but under normal circumstances it could not prevent the carriage from sticking due to heat effects. The carriage, therefore, is mounted on a system of ball bearings held against the ways by spring-loaded bell cranks.

Any dirt on the ways or warpage of any part will not prevent free passage of the carriage over the ways. Since initial adjustment, this machine has hardened 15 to 20,000 pieces with no change in alignment accuracy.

Some flame-hardening applications include sprockets and clutch dentals which are progressively hardened by manual equipment; roller rims are done by circular, progressive equipment, and a large sheave is also hardened by this method using a contoured head.

A coal pulverizer body is another circular, progressive operation where hardening is done in adjacent passes. The material in these pulverizers is ductile iron, which provides an excellent base for flame-hardening.

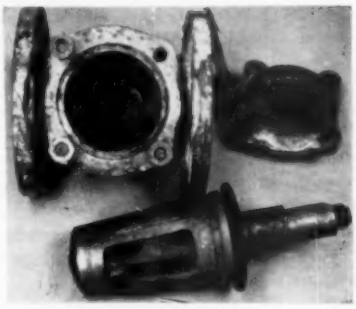
Quality of Flame-Hardening

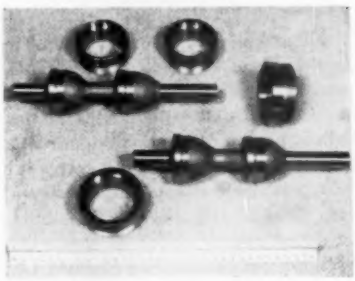
In general, a greater hardness can usually be obtained by flame-hardening than the hardness ratings in the manufacturer's handbook for heat-treating. The process usually can be used on any steel which hardens by heat and quench.

We regularly flame-harden with a water quench most of the air-hardening types including a 12% chrome die steel containing 0.80% molybdenum, 0.20% vanadium and 1.5% carbon.

To determine surface hardenability (as distinguished from standard hardenability tests) we heat with a welding torch on the surface to any temperature above that listed as critical for the particular steel. A water stream is immediately applied to aid in quenching the spot.

A hardness traverse is then made with a Rockwell C-scale test across the spot in increments of 1/16 in. At some point, an area is found where





COBALT and nickel-base alloy types are most widely used in hardfacing mechanical parts like those above.

FLAME-cathodizing process was applied to these roller rims which run in water. Application successfully prevented trunnion wear.

optimum temperature was reached for maximum hardness. This hardness is considered the top surface hardenability of the material, and it is almost always considerably higher than the hardness listed in a handbook as the maximum to be obtained by heat-treating.

Case-Hardening Depths

For most work, case-hardening depths are in the 1/8-in. range. However, depths from 1/16 to 1/2 in. can be obtained. An adaptation of the Brinell testing method was devised to measure case depths nondestructively.

A heavy load is applied on a standard Brinell steel ball. If the case-hardened area is under 3/16 in., the case breaks through. Amount of break-through, as measured by the width of the ball impression, is a measure of case-hardened depth for a given steel and a given type of hardening equipment. Accuracy within 0.01 in., as measured by etch tests, has been obtained by this means.

A lack of distortion is one of the more desirable features of this process. The case depth that is heated releases stresses only in that area and, in cylindrical work, symmetrically arranges the new stress to aid straightening.

Flame-Cathodizing

An example of a difficult problem made easier by this means can be found in a hot oil plunger which is hardened end to end with a total run-out of less than 0.005% after hardening. Cold straightening is undesirable here since the part is hollow for two-thirds of its length. Proper arrangement of equipment is required, however, to obtain such extreme precision.

Another, and perhaps little-known property of flame-hardened work is that in an electrolyte it appears to be cathodic when compared to the unhardened areas of the same piece. This was first noted in a hydraulic cylinder which had been progressively hardened in bands.

The method was tried on some roller rims which run in water. These were flame-hardened to resist trunnion wear and, if possible, corrosion. The same cathodic effect was again noted and the rims were protected. This is the operation called flame-cathodizing.

Greater Strength

Still another important but, by comparison, little used property of a flame-hardened case is its characteristic of strengthening the part in tension, compression and fatigue. Earlier work done on flame-strengthening showed an endurance limit of three times the original. Tensile strengths up to twice those of the original can be obtained, depending upon the section.

Over the past two decades, flame-hardening has been used on many applications. Some of the more promising of these have not been successful. The utter simplicity of the process in its essentials has often created the false assumption that it was simple.

This assumption may be correct when applied to a wide variety of materials and sections. However, in its own field on larger work and where specialized results and more critical materials are applied, the characteristics of the case merit prime importance.

Case Characteristics

Case characteristics obtained in flame-hardening will vary with equipment and techniques used. As mentioned previously, a great bulk of work, processed by almost any equipment, will be satisfactory even though it is produced by a wide range of operating conditions.

For the more specialized result, the type of case becomes extremely important. The hardness gradient of a typical case is gradual by comparison with many other surface-hardening methods. It can, however, vary considerably in gradient between different examples of flame-hardened work.

There is a considerable variation in results possible in one flame-hardening operation. The sharp-gradient case produces shrinkage of the part and leaves the case in tension. Such a case is susceptible to cracking and failures. Some promising work undoubtedly has been prevented because this type of case was accidentally produced.

Flame-Hardening Spreads

The recent, marked increase in the use of the flame-hardening process—particularly in maintenance operations—can undoubtedly be credited to an appreciation of the importance of case characteristics. It also indicates a knowledge of where skill is required in the production and use of equipment.

On most small pieces, flame-hardening is not economical in competition with other surface-hardening means. Commercial work done in this area of application has not left the flame treater enough revenue to construct equipment types required to do specialized jobs.

On large work, however, it has the field to itself. On such sizes there is no other practical method to produce added surface hardness or strength. In this area, there should be a great deal of future development.

Flame-strengthening shows special promise in those areas where strength must be given without the addition of weight—and the petrochemical industry certainly is included in this group.

No. 5 in a series

THESE field-erected oil storage tanks were fabricated with the E6013 electrode defined by the author as a Z-type.

Filler metals for joining

BY ORVILLE T. BARNETT*

PERHAPS the easiest way to visualize the two distinct types of E6013 electrodes is to think of them as horses and zebras. Even when these two animals are in the same enclosure, they may readily be identified.

To simplify this analysis, the horses will be the E6013 electrodes intended —through singular variations in coating formulation—to be used on sheet-metal applications. Zebras will be those E6013 electrodes designed for heavier welding applications.

This mnemonic system will be followed throughout the article by stating E6013-H or E6013-Z when either a sheet metal or a heavier welding application is described.

Two distinct fields of use are covered by E6013 electrodes. The E6013-H types are chosen for light-gage applications, such as aircraft tubing, sheet metal cabinets, ornamental ironwork and outdoor furniture, automobile bodies and hot-air furnaces.

The E6013-Z variety is used on earth-moving equipment, field-erected storage tanks, structural work, railroad cars and farm implements.

No Classification

Actually, no E6013 specification existed until the World War II barge building program began to consume huge quantities of a new electrode, the first E6013-Z, which was variously termed an E6010, E6011 and E6012.

According to specification requirements of that day, each claim was correct. Specification writing bodies, therefore, tightened their requirements to restrict an electrode to one classification only.

The new electrode fell into the E6013 group, as did the already established E6013-H which had been masquerading successfully as an E6012 on work that was never subjected to code or government agency inspection.

In more recent times, adoption of E6024 and E6027 classifications for iron-powder electrodes is another example of adding classifications for new electrode types.

For a-c applications in the late 1930's, a better electrode was sought. Many transformer builders were producing a low, open-circuit voltage unit which was difficult to sell because existing electrode types—E6010, E6012 and E6020-E6030—weren't suitable for light-gage welding with a-c.

Today, the modern design of E6012 electrodes would be acceptable and, of course, the E6020-E6030 types were all right for heavy welding.

To satisfy this market, the E6013-H type was developed. It possessed remarkable arc stability and easy striking characteristics. Soon the new electrode and the low cost a-c transformer

*Assistant Manager, Metals Research Dept., Armour Research Foundation of the Illinois Institute of Technology, Chicago, Ill.

—Photos courtesy Chicago Bridge & Iron Co.

INCORPORATING newer, more economical storage design, these oil tanks owe their strength to the E6013 electrode.

Horses and zebras trot into the ring to help the author trace the development of, and define the uses for two distinct E6013 electrode types. *Isn't this an area which needs official AWS-ASTM clarification?*

began to capture the maintenance and small shop market.

Good for Sheet Metal

Even though there were fewer welding engineers to experiment with new products over 15 years ago, it didn't take long to discover that the wonderful a-c arc stability of E6013-H electrodes made them most desirable for sheet metal welding.

There are nearly two E6012 electrodes used for each E6013. But in the 1/16-in. diameter, E6013 is about 40 times more popular than E6012 (Table I); 5/64-in.-diameter E6013's are favored almost 200 to 1. In the 3/32-in.-diameter category, E6013's are on top in a 3-to-2 ratio and the 1/8-in. diameter is about 18 to 15 for the E6013 type. These figures represent actual tonnage consumed.

A novice in the order of welding engineers, who has been following this series of articles closely, might want to protest. His good memory has told him that E6010, E6011, E6012 and E6013-H electrodes are all used for sheet-metal welding.

Each type described was better than the one before until he reached the summit with the E6013-H. That's true, and a few examples will prove why all four types may be used.

Application Examples

In these examples, sheet metal ranges from 18 to 10 gage. On a flat position butt weld, E6010 or E6011 electrodes with d-c straight polarity for the former, or d-c straight polarity or a-c for the latter, are recommended.

In this case, a Tig-like (tungsten inert-gas) weld is made, the objective being to melt edges together with the coating forming a protective atmosphere. Very little filler metal is added from the core wire.

Similar conditions exist for vertical-down butt welds. Edges may be melted together with E6010 or E6011 using d-c reverse polarity or a-c. An E6012 electrode can also be used with d-c straight polarity.

Greater heat capacity of vertical-down welding suggests a preference for E6012 where slag control may be easier than with E6013-H. Here, too, d-c straight polarity, or a-c are both good.

Lap joints are very useful for sheet metal fabrication. Here again, heat capacity in the joint is so good that E6012 or E6013-H electrodes may be selected with d-c straight polarity or a-c.

On some corner welds, the manual arc-welding electrode supplies melting ability in a protected atmosphere. Understandably, E6010 and E6011 electrodes using d-c reverse polarity or a-c do a fine job for this application.

Likewise, edge welds which exhibit adequate heat capacity can be joined with the same electrode types.

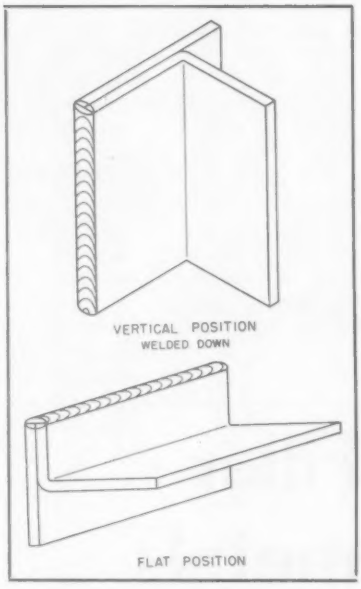
Schools of Thought

One school of thought uses the electrode only as a heat and atmosphere source. The other school uses a very stable electrode and adds filler metal most of the time.

This second school must be more widely followed, as the tonnage comparisons of Table I prove. Note that in the sizes below 1/8 in. in diameter, which must be used for sheet metal work, the E6013 type is applied more extensively by far than the other grades combined.

In the 1/8-in. category, tack welding and other uses tend to interfere with a true reflection of sheet metal welding requirements although the E6013 type still leads.

For best production speeds, choose those electrodes just cited as examples. The number of low-production



TWO examples of edge joints on which E6010 or E6011 electrodes may provide better welds than either E6013 type.

special jobs possibly explains the greater application of E6013-H for sheet-metal joining.

Of course, weldor selection plays an important part. Most E6013-H electrodes are so stable and work so easily that the weldor feels as comfortable as he would at home in his easy chair.

Aircraft Welds

Light-gage aircraft tubing, such as SAE 4130, is customarily welded with E6013-H electrodes. Dilution of weld metal by base metal results in enough carbon and alloy pick-up to assure adequate weld metal strength in heat-treated structures.

The outstanding arc stability of these electrodes for thin-walled aircraft tubing changed the basic welding process from gas to arc welding.

Undoubtedly, the immense popularity of E6013 electrodes is associated with light-gage welding applications. Yet the E6013-Z electrodes have demonstrated important advantages for heavier welding uses. Let's consider these advantages.

During World War II, the insatiable demand for weldors placed a heavy burden on those who had little training. These welding school graduates found the new E6013-Z electrodes most helpful.

The arc was extremely stable and kept going despite the shakiness of

TABLE I

RELATIVE TONNAGES OF

E6010, E6011, E6012, AND E6013 ELECTRODES

USED FOR SHEET METAL WELDING

Diameter (in.)	E6010	E6011	E6012	E6013
1/16	1	0	4	145
5/64	2	0	2	300
3/32	450	560	2,000	3,400
1/8	14,500	5,000	15,000	17,500

A lot of AO† engineered Eye Protection ...and a lot of Comfort, too!

AO F600

and F625
head-rest goggles

Here's eye protection that's tops with gas welders, burners, cutters, brazers and furnace men who want the finest in a head-rest goggle for wear directly over eyes or spectacles. Gives 4-way protection against injurious light radiations, glare, flying sparks, scale. A key feature is the perfect balance — for real comfort. Everyone notes and appreciates the lack of overhanging weight even when goggle is "off-guard". The F600 and F625 are similar except latter has large coverglas type cup. Your nearest AO Safety Products Representative can supply you.

Quick Facts

- ADJUSTMENT — By thumbscrews to fit facial contours and provide correct pupillary distance. Spring mechanism throws goggle into "off-guard" position.
- HEADGEAR — Fibre, fits snugly. Adjusted by nut turning on right and left hand threaded stud. Genuine leather sweatband.
- EYECUPS — Opaque and fit snugly and comfortably.
- SIDESHIELDS — Light-tight, adequately ventilated indirectly.
- LENSES — Noviweld or Filterweld. Shades 3, 4, 5, 6, or 8. Easily replaceable cover lenses protect filter lenses from pitting or scratching. (Please specify type of lens and shade number.)

American Optical
SAFETY PRODUCTS DIVISION

SOUTHBRIDGE, MASSACHUSETTS • BRANCHES IN PRINCIPAL CITIES

† T. M. REG. BY AMERICAN OPTICAL COMPANY

TABLE II

TYPICAL MECHANICAL PROPERTIES

OF E6013 ELECTRODE DEPOSITS—AS WELDED

Yield strength, psi	55,000-65,000
Ultimate strength, psi	67,000-78,000
Elongation, % in 2 in.	17-25
Reduction of area, %	25-50
Impact strength, Izod ft-lb	25-50
Endurance limit, psi	25,000-30,000
Specific gravity, grams/cc.	7.82-7.86
Corrosion resistance	Comparable to mild steel
X-ray quality	Excellent

the novice weldor. No matter what the operator did, the electrode would not undercut. Slag was virtually self-cleaning.

Always a Good Weld

Spatter was so slight that the nervous neophyte did not encounter a series of nerve-disturbing burns as molten globules found and stung the slightest area of exposed skin.

Even when laid by the least-skilled weldors, beads were apt to be uniform, smoothly rippled and of good quality.

Most golfers take an added interest in the game because of the combination of exercise and outdoor activity it offers. They do not feel the use of a golf cart defeats the exercise objective.

This situation is analogous to E6013 electrode welding. It has become as popular in its way as the golf cart because it makes arc welding much easier.

Earth-moving equipment has been fabricated from heavy plate with E6013 electrodes. Fillets are flat, and by applying a spatter-proof compound prior to welding, cleaning costs become insignificant.

The welds look good, and field experience has proved they *are* good. Because the welds are so easy to make, production rates have reflected a higher operating factor as the weldor spends more time welding.

In the Field

Field-erected storage tanks have been built with E6013-Z electrodes. Out-of-position welding may be almost twice as fast as that done with E6010 or E6011 electrodes, and quality of weld deposit is generally excellent.

Before discussing mechanical properties of E6013 electrodes, as reported in Table II, it may be timely to forecast their future.

Light-gage welding will continue to be performed with E6013-H electrodes, unless Tig welding with inexpensive shielding gases offers a greater economy. The E6013-Z electrodes may lose ground to iron-powder electrodes. Even some field welding of large structures may be done with iron-powder electrodes.

Strengths of E6013 electrode deposits equal or exceed mild steel. In the special case of tubular aircraft assemblies, strengths are very high. Ductility is good for all diameters from 3/16 in. down, but it may become marginal (from a specification standpoint) in larger diameters.

From field experience data, both ductility and impact strength have been good enough for earth-moving equipment and railroad cars. X-ray quality is extremely good.

Some Cracking

Some variations in deposit quality attributable to base metal, core wire or coating compositions have been encountered in E6013-Z types. Sporadic outbreaks of weld metal cracking have resulted.

Virtually every classification of electrodes can produce cracked welds under certain extreme conditions. Yet, the case with the E6013-Z is somewhat different. Fortunately, such experiences are infrequent.

Coating compositions for E6013 electrodes are similar to those found in E6012 types. Some cellulose is used to provide gas shielding. Rutile, serving as an arc stabilizer and slag former, is the principal ingredient.

Aluminum and magnesium silicates are auxiliary slag formers, while calcium carbonate is a slagging ingredient with additional arc-stabilizing attributes.

Ferromanganese serves three purposes: (1) deoxidation of the molten pool; (2) restoration of manganese in the weld deposit, and (3) contribution to friable (glass-like) characteristics of the slag.

Alkaline arc stabilizers and silicates, including potassium, round out the recipe for E6013 coatings.

Weld Metal Analysis

Weld-metal chemistry is reported in Table III. The weld metal of E6013 electrodes has fewer non-metallic inclusions than E6012 deposits.

Narrower current ranges are suggested for E6013 electrodes than for E6012's because the E6013 coating may deteriorate more quickly at high current values.

One purchasing agent, during a period of electrode shortages, couldn't understand why his weldors *had* to have E6013 electrodes. After all, he suggested, weren't all coated electrodes made from similar materials?

They were, an enterprising salesman agreed, just as all oil paintings were produced from essentially the same raw ingredients!

REFERENCES

Manufacturers catalogs.

Tentative Specifications for Mild Steel Arc-Welding Electrodes (AWS Designation A5.1-55T; ASTM Designation A233-55T), Mar. 7, 1955.

Weld Standards for Use in Applying Weld Design System, Lincoln Electric Co., 1951.

TABLE III

TYPICAL DEPOSIT ANALYSIS OF E6013 ELECTRODES

Element	Core Wire, %	Deposit, %
Carbon	0.10-0.15	0.07-0.15
Manganese	0.40-0.60	0.30-0.60
Sulfur	0.035 max.	0.04 max.
Phosphorus	0.025 max.	0.04 max.
Silicon	0.03 max.	0.05-0.40
Copper	0.15 max.	0.15 max.

Note the stringers of Stoody 21 which act as "buffers" between abrasive earth and bucket sides. Inside surfaces of bucket receive similar protection.

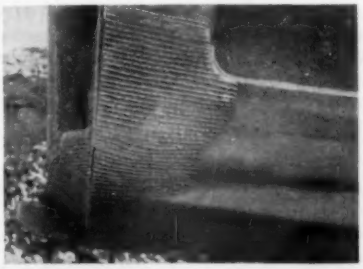
All Buckets Take a Beating... Here's the Medicine!

We're often asked about bucket maintenance, what hard-facing material to use and how to use it for maximum wear protection. Actually, your own equipment gives you part of the answer. Each bucket wears differently, depending upon how it is used and the kind of material handled. By watching for development of wear patterns, then hard-facing these areas at definite intervals, you'll get extended service with greatest economy. *Remember, a frequent touch-up is better than a major repair*...more economical in hard-metal and less costly in down time.

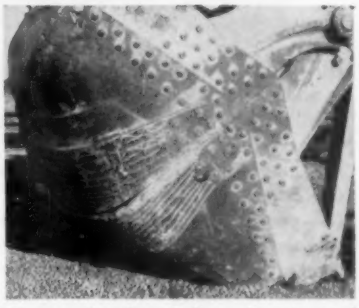
If buckets are severely worn, first build up with Stoody Manganese. For hard-facing, the alloy most commonly used is Stoody 21, preferred because of good wear resistance, fast deposition rate and low price. Occasionally, under conditions of excessive abrasion, Coated Tube Stoodite gives longer life on shovel teeth and reduces maintenance costs.

Full particulars on alloy recommendations and hard-facing procedures are in the Stoody HARD-FACING GUIDEBOOK. Ask your dealer for a copy (check the "yellow pages" of your phone book) or write direct.

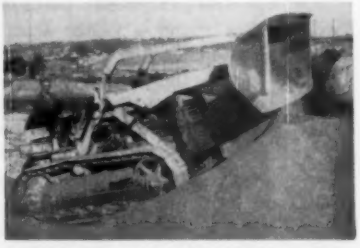
Bucket teeth (top illustration) and adapters (above) are amply coated with Stoody 21. Hard-faced teeth on this job averaged two full shifts of extra service before needing additional hard-facing treatment.



These Stoody 21 beads across the bucket resist severe abrasion as it is dragged across rubble, returning for a new bite.



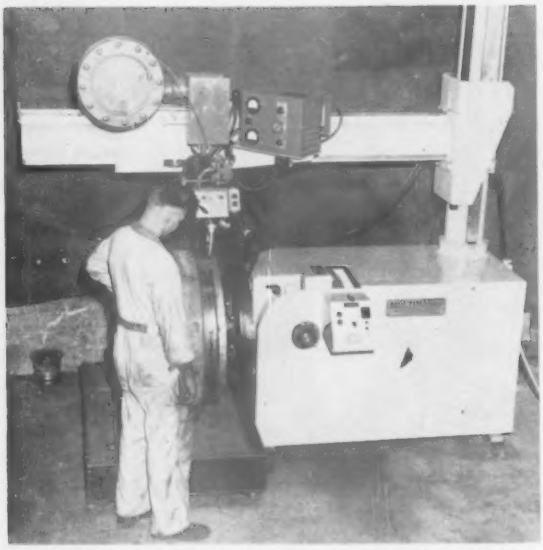
Lips on this clam shell are kept in good shape for a tight seal with Stoody 21.



Scoop lifts often lead a tough life. Here, lips, sides and bottoms are kept in good condition with Stoody 21. Occasional touch-ups are made as wear occurs.

STOODY COMPANY 11941 East Slauson Avenue, Whittier, California

See the STOODY EXHIBIT—WELDING SHOW—Buffalo, N. Y., May 9-11.



WITH turret head removed, all-purpose hardfacing machine becomes a variable-speed positioner with 3,000-lb capacity.

SIX-spindle turret head handles both flat and cylindrical parts and is largely responsible for increased production rate.

Hardfacing positioner doubles production

AUTOMATIC welding in hardfacing applications has been used successfully for over a decade. Its growth has been constant, and will undoubtedly continue at an accelerated rate.

Shop experiences of Automatic Welding Co., Elm Grove, Wis., have uncovered many important factors in this highly useful field over the past four years. One of the most important conclusions reached by the firm was the fact that few users pay sufficient attention to all-important fixtures and jigs.

Ivan Bartter, general manager of Automatic Welding Co., noted that "most prospective users purchase welding heads and a power source and never even consider the most important factor—the fixture."

The manufacturer or job shop owner who approaches the problem in this manner, Mr. Bartter continued, has to "cobble up a beam to hold the head and a turning device to rotate parts, and his wonderful expectations are usually deflated before he ever gets into operation."

Knowing that a good automatic installation can produce high quality hardfacing jobs at a rate of five to one over manual applications, the Wisconsin firm developed an automatic hardfacing machine which can handle an array of widely different parts.

Using this all-purpose fixture in conjunction with the submerged-arc welding process, the company has doubled its production rate on many items while enjoying improved quality.

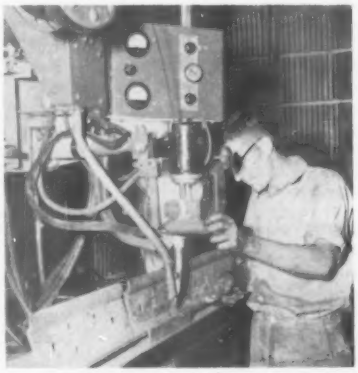
A six-spindle turret head on the new fixture will handle both flat and cylindrical parts, including tractor support rollers, crane and shovel track rollers and house rollers, and sheaves and rollers used on earth-moving machinery.

Removing the turret, Automatic Welding has a standard variable-speed positioner with a 3,000-lb capacity and a speed range of 1 to 20 in. per minute. The positioner will handle such diversified parts as tractor idlers, crane and shovel idlers, sprockets and turn tables, dredge pump head liners, and trunnion rollers and shafts.

The beam carrying the submerged-arc welding head can rotate 360 deg, or travel in a straight line for welding build-ups. In the latter instance, the machine will accommodate crusher jaws, dipper teeth, shovel and dragline buckets, and wear plates used on most crushers.

Automatic Welding Co. is confident that the only way to achieve high production speeds on hardfacing applications is to use automatic welding equipment. The firm is convinced that manufacturers of this equipment and of hardfacing alloys are offering the user materials that are "years ahead" in design and production capacity.

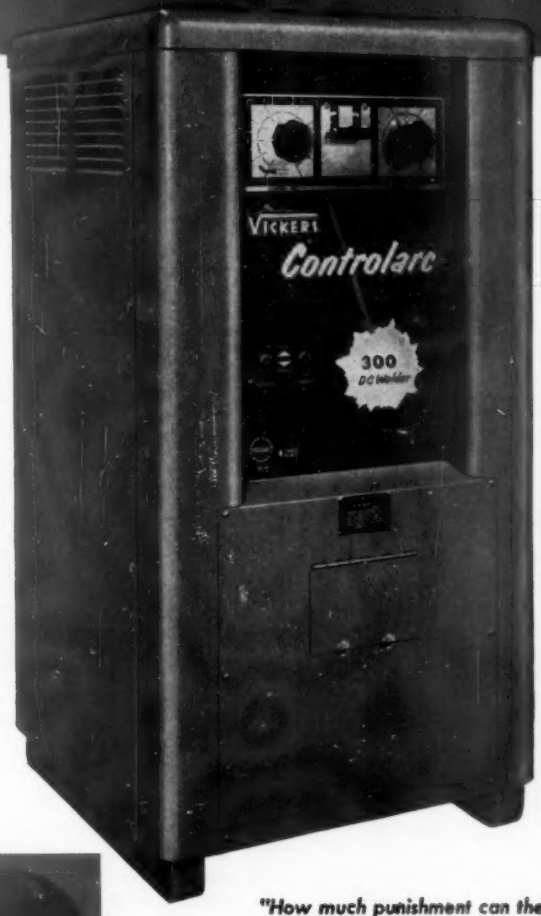
But, to take full advantage of these modern and economical rebuilding methods, the work positioner must be considered as a vital complement to new welding and hardfacing equipment.



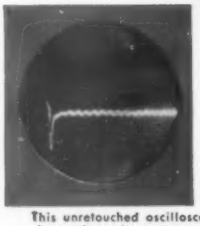
TRACTOR lugs have new grippers welded on using machine in a straight-line application.

VICKERS® Controlarc DC Arc Welder

"Survives Punishing "Durability Test"



OVER 1,000,000 CYCLE HIGH-SPEED REPETITIVE ARC TACK TEST EQUIVALENT TO MORE THAN TWO YEARS OF CONTINUOUS USE



This unretouched oscilloscope photograph shows the voltage trace occurring when the arc was broken very quickly during the test, subjecting the CONTROLARC welder to severe abuse.

"How much punishment can the Vickers CONTROLARC DC Welder take?"

Vickers engineers decided to find out.

A 200-ampere CONTROLARC was subjected to a gruelling durability test. Every nine seconds the welder was charged with a six-second load of 250 amperes (50 amperes above rated capacity) at 27.5 volts. After 198,900 "makes" and "breaks" the load was boosted to 300 amperes at 27 volts. When the test was concluded the CONTROLARC had survived 1,004,522 of these charges, *and was still going strong*—with no apparent effect on any part of the welder. This test simulated arc tacking on production at 4 tacks continuously per minute on an 8-hour day basis for over two 300-day years.

For complete information about this rugged, dependable welder, write today for new bulletin.

Some territories open for qualified dealers. Write for details.

VICKERS ELECTRIC DIVISION

VICKERS Inc. a unit of Sperry Rand Corporation

1851 LOCUST STREET • SAINT LOUIS 3, MISSOURI

WELDED steel work of the new St. Rose bridge. Bridge is thought to be the longest continuous-girder type in the world, since its 14 spans are joined by welding.

REMAINDER of web joint is completed by weldor after flange plates have been welded in place.

Welded bridge sets a new length record

BY HUGH JARMAN

THE RECENTLY completed Saint Rose Bridge, north of Montreal, Canada, is believed to be the longest welded continuous-girder bridge yet built. Its 14 spans stretch in one continuous length for 1,550 ft across the River des Milles Iles, on the main highway to the famous Laurentian Mountain resort area.

The present bridge replaced a remarkable old wooden structure built on rock-filled timber cribs. It had been in service since about 1830, when the charter for its construction was granted by King William IV of England. Some of the largest and heaviest pieces of road transportation equipment permitted on modern Quebec highways had travelled safely over this wooden bridge.

Individual spans of the new bridge vary from 90 to 125 ft in length, and they are arranged symmetrically and fixed at the center pier. All other bearings are carried on expansion rollers. Girders are spaced 32 ft apart and carry a 52-ft 8-in. concrete deck which accommodates a 42-ft roadway and two 4-ft sidewalks.

Safe uniform load for the roadway is 100 lb per sq ft. It could, theoretically, carry two 25-ton or four 20-ton trucks abreast.

One notable feature of design is the utilization of the concrete deck as a lateral bracing system, thus adding a further element of economy to that already gained through welding.

Construction Economy

Use of continuous construction also aids economy since it eliminates the necessity for duplicate pier members, floor beams and sway-bracing at each pier. What is perhaps more important to the motorist, it provides a smooth road surface unbroken by the customary and often troublesome intermediate expansion joints.

The deck of the St. Rose Bridge (8 in. thick in the road and 6 in. in the sidewalks) rises on a vertical curve to a height of 8 ft at the center pier.

Top flanges of the girders are parallel to this curve, and bottom flanges are arched to provide maximum clearance for small pleasure craft using the river. Curved arches also add to the pleasing appearance of the bridge.

WELDOR lays down metal on flange plate joint between bolts and pins which served to keep bridge sections in alignment for field work.

Girders vary in depth from 9 ft at the center pier to 4 ft 7 in. in the 90-ft shore spans. Their 22-in. flange plates vary in thickness from 1½ to 2¾ in.

Web plates ½ in. thick were used throughout, with heavy plate stiffeners over the bearings, and inside stiffeners only at intermediate points. The latter consist of 6 by 3½ by 5/16-in. angles welded to the webs to provide buckling strength equal to conventional double-angle stiffeners.

Every second stiffener is cut and capped to form a seat for the floor beam. This is welded to the girder web for shear only.

Progressive now offers YOU welding equipment built to your requirements on a TRUE LEASE basis.

Get that equipment you need now! Let it pay its own way.

- **No capital tie-up.**
- **Small cash outlay.**
- **Finest welding equipment built to YOUR specifications.**
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A sound idea with many advantages for YOU. We will be pleased to give you full details. Write or Phone.

IT PAYS TO WELD

RWMA MEMBER

PROGRESSIVE *Welder Sales Company*

915 Oakland Avenue • Pontiac, Michigan

PERCHED above River des Milles Iles, weldor attaches a knee bracket as a stiffener and a floor beam support at one bridge pier.

HOLES made for alignment pins and bolts are plug-welded after section is completed. Such work added to over-all bridge appearance.

Welded cantilever brackets are similarly faced, welded for shear only and connected to the floor beams by tension straps over the girders.

Bracket Bracings

Bottom flanges on girders are braced by knee brackets from every floor beam in the compression zone, and from alternate floor beams elsewhere. Over the piers the floor beams are deep, welded girder sections also proportioned to act as brace frames adequate for all lateral forces.

No permanent top or bottom laterals are provided, since the concrete deck is calculated to resist all lateral loads. Light temporary diagonals were installed to align girders for erection and welding, but were removed after the concrete deck had been poured.

At the abutments, flush roadway expansion joints (the overlap, finger type) provided for total movement of 9.7 in. for half the bridge. This lee-way is equivalent to a temperature change from —40 to 120 F over a length of 775 ft.

The joints are heavily anchored into adjoining concrete to resist tension in case of a sudden freeze-up and resultant troublesome ice formation.

Thin Flange Plates Used

Pier members supporting the girders are provided with disc bearings for equalizing loads, and have rollers varying from 5¾ to 6¾ in. in diameter. Rollers are mounted in completely enclosed roller nests.

The direction of their motion is positively controlled by pintles set in the shoe and bed plates, which engage the center roller. The whole assembly can easily be inspected.

Full-length flange plates of the required sizes could not be supplied by Canadian mills, so thinner flange plates were introduced on either side of field splices. This substitution resulted in savings of material and reduced field welding—some compensation for the additional shop work.

Total weight of structural steel in the bridge is 1,180 tons, or 1,520 lb per lineal foot, exclusive of handrails and lamp standards.

In fabrication, web plates were first laid out and flame-cut to correct profile, including the dead-load camber allowance. All web details were then welded in place.

Flange plates were butt-welded, pressed or rolled to proper curvature, then assembled with the webs and squared by temporary braces.

Field Welding Procedure

Continuous fillet welds were applied alternately to top and bottom flanges in a sequence that limited over-all vertical distortion to a minimum of ⅛ in. Flanges and web plates, which had been left long, were then flame-cut to finish length and prepared for field welding.

Adjoining girder segments were progressively shop assembled in correct alignment on the flat. Field splice holes were drilled from steel templates, which also were used for drilling temporary field splice plates, and correct assembly was assured by means of pins.

In the field, girder sections were assembled with complete reliance on the pinned erection splices for accuracy of alignment. It would have been impractical to calculate in advance the correct elevation of these partially strained members.

Level measurements were taken after seven spans had been erected, and indicated an extreme error in elevation of ⅝ in. in the first span and less than ⅜ in. in those following.

Field welding began after the third span had been assembled, and weldors kept this distance behind the erection crew. All welding was done from scaffolds which allowed freedom of motion and accessibility.

Initial procedure for girder splices called for welding to commence at the center of the web plates, proceeding outward to the flanges. This procedure was changed when web buckles appeared during the flange welding operations.

They apparently were due to a release of locked-up stresses when top splice plates on the flanges were removed to permit welding. These buckles were eliminated after the flange welds had been completed by flame-cutting the webs and re-welding them.

The new procedure entailed butt-welding the flanges, partially welding the web for a distance of 12 in. from top and bottom, completing the flange welds and then the web. The object was to balance as much as possible longitudinal contraction, which amounted to 5/32 in. per joint.

Splice holes in flanges were simply filled with plugs and welded over since the net areas were more than ample for calculated stresses at these points. Bolt holes in the web plates, however, were completely plug-welded for appearance.

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Spot welding aircraft parts

RESISTANCE welding processes, which found early acceptance in the aircraft industry, are being given even heavier and more diverse work loads as this still-young industry moves rapidly into jet plane production.

But sleek jets are not the only planes to benefit from the strength and versatility of resistance welds. At Beech Aircraft Corp., Wichita, Kans., military and commercial propeller-driven aircraft are produced with all the economy and speed inherent in the spot welding process.

Steel, aluminum and magnesium components are spot welded at Beechcraft's plants in Wichita and Herington, Kans. Cabin doors and window frames, fuel tank bulkheads and control surfaces are among the many vital parts joined by this welding process.

Test Procedures

Quality control of components headed for spot welding applications at Beech is a thorough process. Continuous machine checks and careful material preparation are routine procedures.

A daily surface resistance test is run on all metals to be spot welded and, as each operator begins a different job, he brings a sample strip of material for an individual test.

MECHANICAL etcher and dryer cleans jet fuel tank fins for spot welding application.

LANDING gear door for commercial aircraft is spot welded to achieve light weight plus needed strength.

This initial job-starter test calls for a check on the following points:

(1) surface cleanliness of metal as measured on an electrical resistance tester;

(2) shear strength, measured on a pull-test machine exerting forces up to 10,000 lb, and

(3) a penetration test examined by magnification.

To insure a high degree of surface cleanliness, Beech conducts a series of rinses and etches which do an excellent job of cleaning parts to be welded.

Cleaning and Etching

A crane is used to hoist a basketfull of parts into and out of six large tanks for the principal cleaning operation. The first dip removes surface layers of oil, dirt and grease. Successive dips rinse the parts, etch them in acid solutions to remove conductive layers such as aluminum oxide, and rinse them again to arrest further acid action.

Parts are then dried for two to five minutes in a steam dryer before welding.

All parts which have previously been heat treated are cleaned separately in a huge washer. Here the etching, rinsing and drying is carried out in a single mechanical operation.

Beech Corp. is particularly pleased with spot welding—as are other aircraft manufacturers—because it adds no weight to the finished product, work-time and production costs are decreased and aircraft flight characteristics are enhanced by resultant smooth surfaces.

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"Pay-Off-Pak" shipments can be furnished in all grades of carbon steel, low-alloy steel, stainless steel, and aluminum wire.

For further information, see your distributor or write us direct.

By using the Raco Turntable, wire up to 3/16" in diameter can be used in submerged arc welding.

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SOLD BY WELDING SUPPLY DEALERS

This reader pinpoints:

The need for unity

Letters to the editor usually can be found in the section regularly devoted to them. This strong appeal for common sense, however, warranted an exception to the rule.

YOUR EDITORIAL, "Seek and Ye Shall Find," in the December, 1955, issue, and the letter of James G. Brunt of Massena, N. Y., "Why not welding for the St. Lawrence Seaway," are subject to the same comments so far as structural welding is concerned.

Suppliers of welding equipment seem unable to get together on what they should do for their mutual benefit. Each one runs his own show regardless of what the other fellow is trying to do.

I am interested in structural welding, an almost completely undeveloped field compared to what it could be. I know from experience it is possible to effect big savings in steel and labor costs, both in the shop and in the field, through the use of welding.

Structural welding is in the same position as the cement industry in the period from 1905 to 1920, when each cement producer was an individualist in promoting wider use of cement.

In the building industry, each cement producer was recommending *his* methods to engineers. Some of these recommendations resulted in failures, each of which was an industry setback. Unfortunately the engineers of collapsed buildings "took the rap" for these failures.

No Information Center

Today's engineers, knowing conditions that developed in the use of reinforced concrete, cannot be blamed for being conservative in their outlook on welding. Many of them "let John do it," because there is no common source of welding information. But Portland Cement Association district engineers will gather authoritative information for engineers and visit offices to promote the use of concrete. This type of service sells cement.

If the welding industry wants to sell more material, it must work at the grass roots level of the engineer who develops original designs, and not at the top.

Those engineers who have used welding deserve credit. They, like myself, had to spend plenty of money and time on research before they could develop a welded job. True, the AWS has numerous code specifications, but this is not what an engineer wants to put in his job specification.

Some day, when the following suggestions may have been developed by the welding industry, there will be nothing but welding used in all structures. Some day, fabricators will find that proper use of welding by good engineering design is going to put them back in competition with their chief competitor (for we know many welded steel jobs are more economical than reinforced concrete).

The Writer Suggests:

1—That all manufacturers of welding equipment form an association for their common benefit, promoting greater use of welding.

2—A central headquarters manned by a chief engineer or manager familiar with both design and applied use of weld material, who would issue literature regularly.

3—Local offices in key cities of the U.S. and Canada, to be headed by an engineer familiar with welding processes and capable of giving design advice.

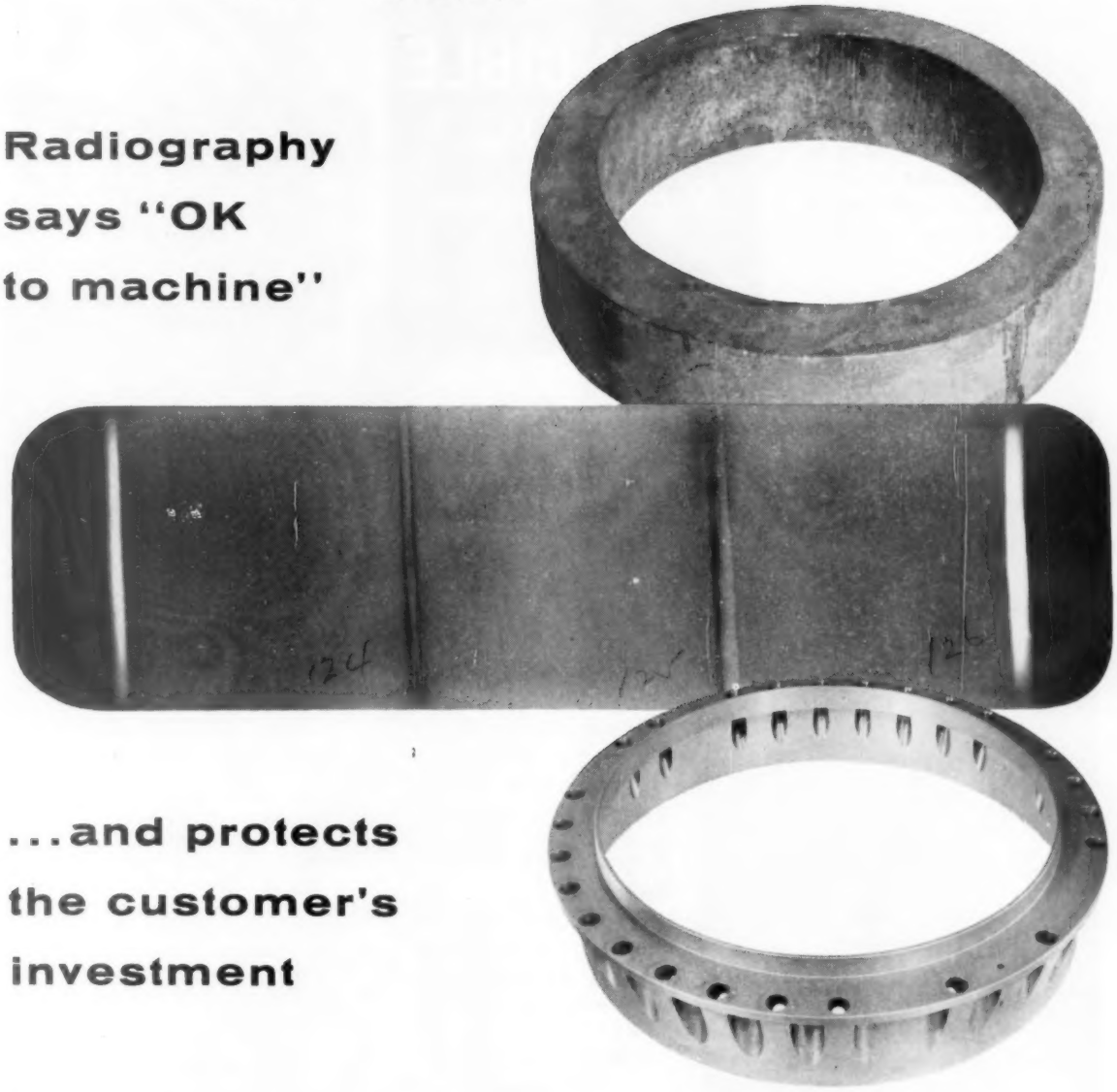
4—Local engineers who keep in close contact with design engineers advising them on benefits gained through welding.

Such an organization would not in any way conflict with competitive selling. This engineering service would be neutral, to help the industry as a whole.

Inaugurate such a service and you will see a tremendous increase in welding volume to answer your editorial and Mr. Brunt's question on why the St. Lawrence steel is riveted when welding could have saved probably a million dollars.

Van Rensselaer P. Saxe
Engineer

Radiography says "OK to machine"



...and protects the customer's investment

The blank for this stainless steel jet engine part starts as a mill rolled bar, is shaped under heat and pressure, and flash-welded to form a homogeneous ring. Any porosity or lack of fusion could put the part in the scrap-heap—scrapping with it the buyer's investment of machining time which is five times the cost of the blank itself.

To guard its customers against such losses, The American Welding & Manufacturing Co., Warren, Ohio, makes extensive use of radiographic inspection. Only rings with welds *proved* sound are delivered to the buyer. Possible loss of machining time—with costs as great as $300—is avoided at the outset.

Radiography does a great job for welding. It saves time and money as in this case. It gives customers great confidence and peace of mind. It opens new applications where the welding process was once frowned on.

Radiography can help you build business. If you would like to know how, talk it over with your x-ray dealer.

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Savings in reclaimed flux alone have paid for Invincible units in a few months, or even weeks, on submerged arc welding jobs.

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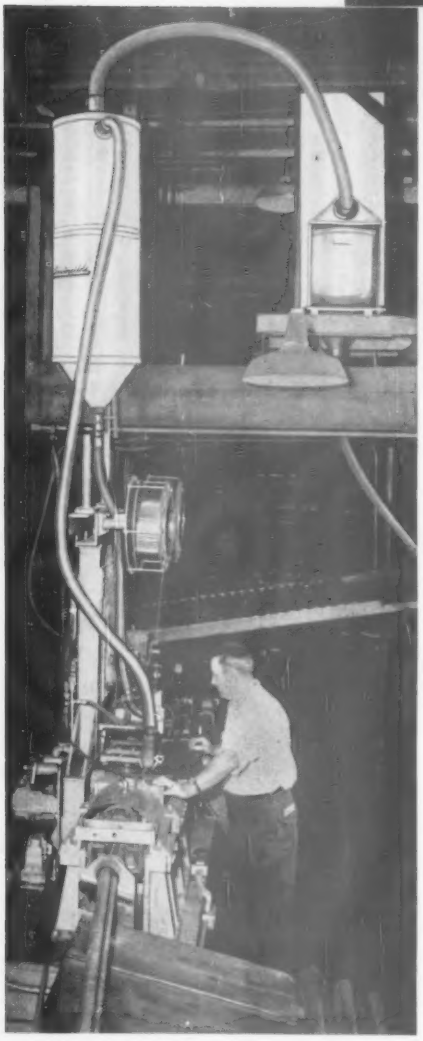
MAKE 3-WAY SAVINGS



Operating continuously, this Invincible recovers all unfused flux from pipe-seam welding operation at a leading automotive firm.

1 *Valuable Flux Reclaimed. Automatic* Invincibles recover *all* unfused flux and return slag-free, dust-free usable flux to the welder—*all in one continuous operation.*

2 *Costly Man-Hours Saved.* Invincibles do the complete job automatically—far more swiftly and efficiently than manual methods.

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- Portable units also available.

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Electrodes

TENTATIVE SPECIFICATIONS FOR CORROSION-RESISTING CHROMIUM AND CHROMIUM-NICKEL STEEL COVERED WELDING ELECTRODES (AWS Designation A5.4-55T; ASTM Designation A298-55T). Published jointly by American Welding Society, New York City, and American Society for Testing Materials, Philadelphia, 1955. Paper, 6 x 9 in., 13 pages. Price 40 cents. Available from AWS, 33 W. 39th St., New York City.

Eight new classes of electrodes have been added to this revised edition of specifications for stainless-steel electrodes. The additions cover the recently developed electrodes which have widened the range of stainless steels, clad steels and dissimilar metals that can be successfully welded.

The new classes discussed are: two extra-low carbon grades (E308ELC and E316ELC); two columbium grades (E309Cb and E310Cb); two molybdenum grades (E309Mo and E310Mo); and grades E312 and E318.

The discussion includes test methods, weld metal composition requirements, standard sizes and lengths, and packaging and color markings for identification. An appendix is provided as an aid to proper electrode selection.

Metalworking machinery

SERIAL NUMBER REFERENCE BOOK FOR METAL WORKING MACHINERY. Published by Industrial Publishing Corp., Detroit, 1955. Paper, page size 5½ x 8½ in., loose-leaf style, leatherette cover.

This reference volume should prove useful to all who buy, sell, or appraise used equipment. The volume contains serial number and age information for most machine tools, presses, forging equipment and industrial machinery manufactured in the United States from 1920 through 1953.

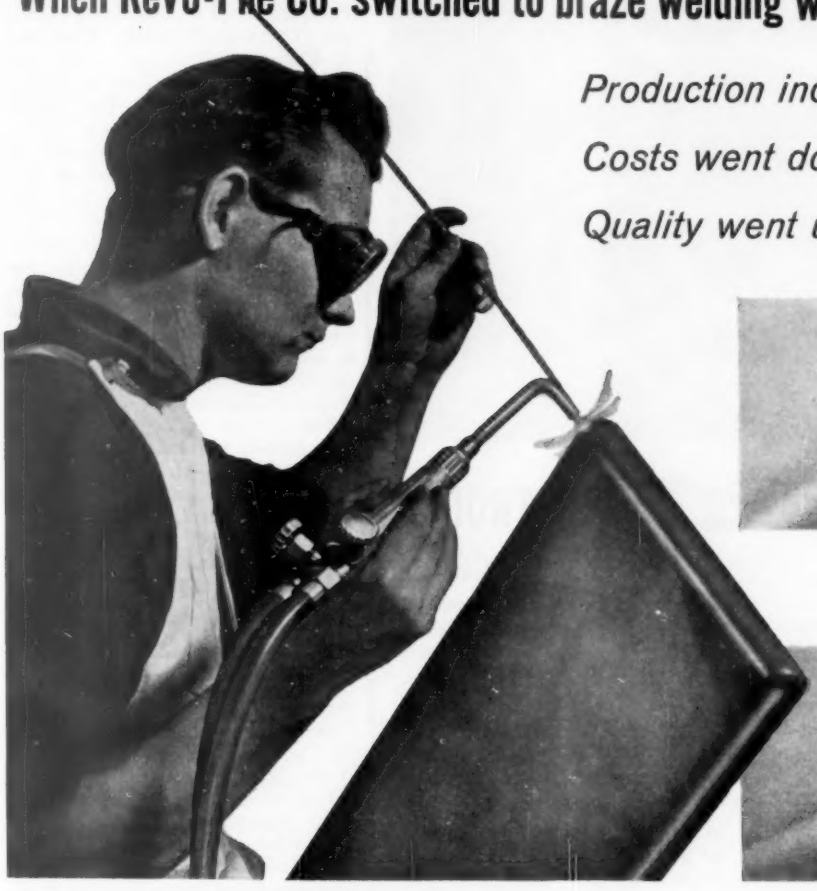
Serial numbers are listed year-by-year; manufacturers are listed alphabetically with one listing to a page. Space is left on each page for notations. A yearly supplement service is available to keep the volume up-to-date.

When Revo-File Co. switched to braze welding with Anaconda Rods

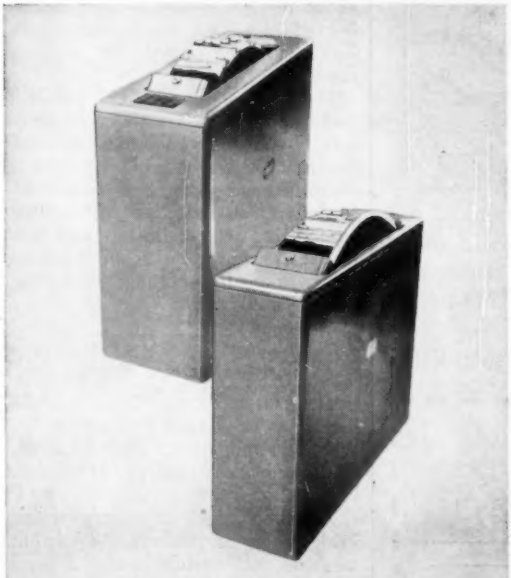
Production increased

Costs went down

Quality went up



Close-up of braze weld in panel corner. Panels are #18 gage mild steel. **Below:** A corner after sanding – the basis for a smooth, perfect enamel finish.



Revo-Files, marketed by the Mosler Safe Company. Unit at left is electrically operated – a touch on a button brings desired section of revolving file into place. Right-hand unit is manually operated. Corners of top and two end panels, plus seams on the locking covers, are braze-welded.

14 superior braze welds in 7 minutes

The Revo-File Company of Freeport, L. I., used to arc-weld panel corners and locking-cover seams on its revolving-file cabinets. But they were troubled by lack of penetration and by considerable porosity.

About six years ago, the Company turned to oxyacetylene braze welding, using Anaconda-997 (Low Fuming) Bronze Rod. They found that the rod flows smoothly, is easy to control – reducing the time required to make the welds. It takes only 7 minutes to complete 14 welds, an average of 30 seconds per weld.

In addition, the welds are uniformly sound and well-formed, reducing finishing time. Thus, for Revo-File Company, the switch meant better product quality, lower costs, and increased production.

Anaconda-997 (Low Fuming) Bronze is a superior welding rod used to join gray and malleable cast iron, steel, and copper alloys by the oxyacetylene process. It is one of a broad line of Anaconda Welding Rods that are finding increasing applications in production and repair welding. Anaconda Welding Rods are sold by distributors of welding equipment everywhere. Whitehead Metal Products Co. of New York furnish Revo-File Co. with Anaconda rods. See your Anaconda distributor or write: The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 55127

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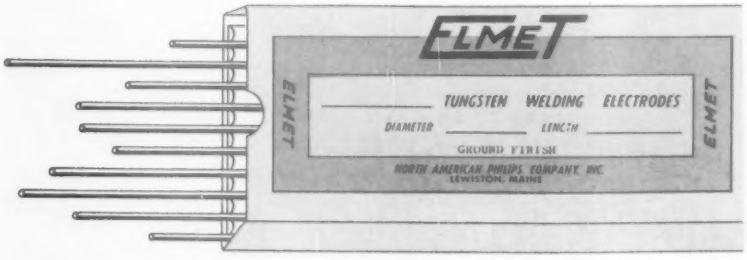

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Maintenance

TECHNIQUES OF PLANT MAINTENANCE AND ENGINEERING 1955. Published by Clapp & Poliak, Inc., New York City, 1955. Hard cloth binding, 8½ x 11 in., 218 pages. Price $7.50.

The proceedings of the technical sessions, held concurrently with the 6th national Plant Maintenance and Engineering Show in Chicago, early this year, are the concern of this volume. The book is composed of the papers that were given at the conference, the stenotypist's transcript of the discussions that followed them and the reports of the round table sessions at which specialized phases of the maintenance function were given intensive consideration.

Some of the topics considered are management requirements in maintenance, control of maintenance activities in process industries, maintenance cost control, sanitation, work measurement and standards, training the maintenance force, and planning and scheduling in various size plants.

Home welding

SELFWELDING—A METHOD FOR MAKING HOME PROJECTS IN METAL. By L. T. Houck. Published by Lincoln Electric Co., Cleveland, 1955. Cloth, 5½ by 8½ in., 128 pages. Price $1.00.

This two-part "how-to-do-it" book fulfills a long-felt need for the hobbyist and handy man about the home. It has been easy to get books for almost everything one might wish to do about the home except—join metals by welding. This small volume tells how with the metal arc welding process.

If you know how to weld, you will find "how-to-do-it" helps on 80 projects. If you don't know how to weld, the first 38 pages will give you a simplified method. There is also information on selection of welding equipment, data on metals and how to weld them, and tips on using an arc welder for cutting, soldering, heating and brazing.

Welded bridge design

COMPARATIVE BRIDGE DESIGNS. Published by The James F. Lincoln Arc Welding Foundation, Cleveland, 1955. Illustrated, cloth binding, 211 pages. Price $2.

This book, by comparing various bridge designs, aims to point out methods of saving material and money through welded design. It presents welded designs of comparable riveted bridges, either existing or proposed, and compares the major elements of principal design types.

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1956 Welding Engineer MID-JUNE

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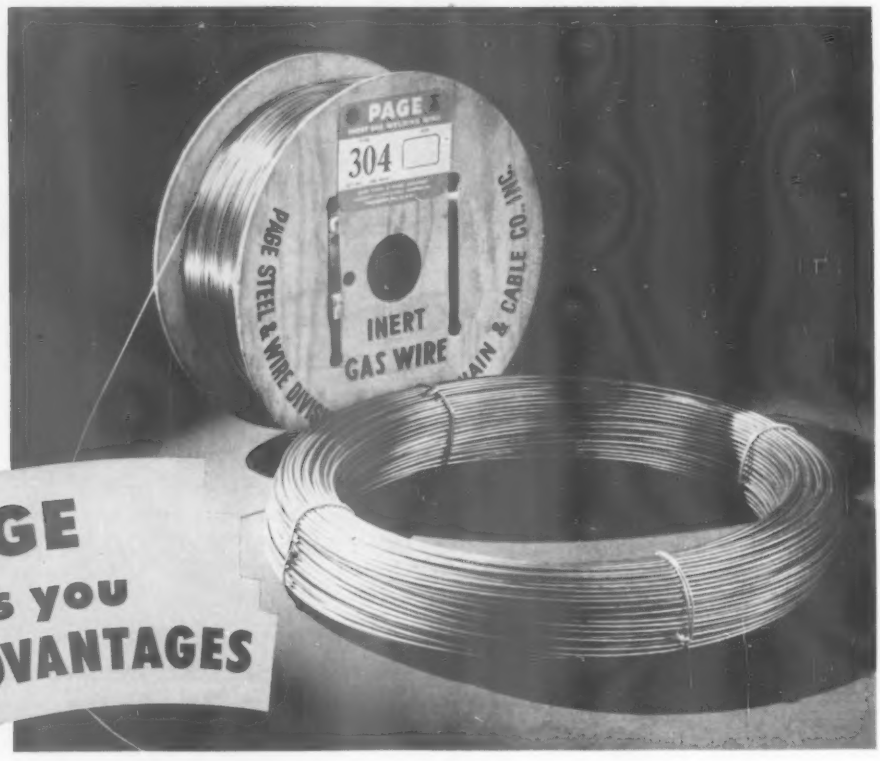

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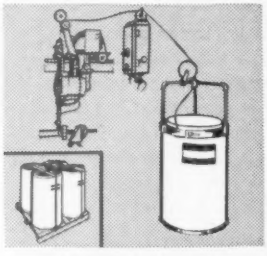

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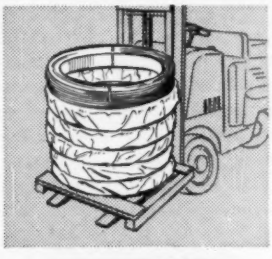

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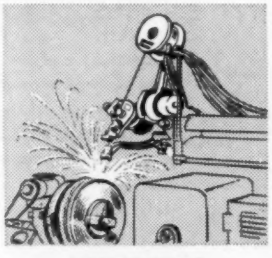

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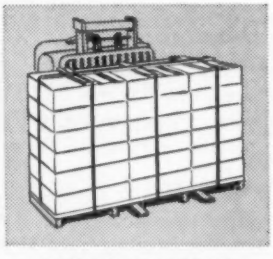

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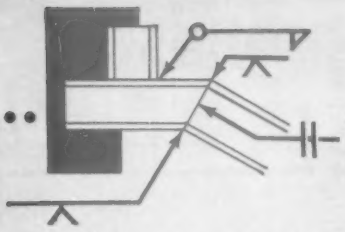


the welding clinic

Here you may find the solution to your welding problems, whether they concern design, production, construction or maintenance welding. Submit your questions for answering on this page.

LP gas flame-cutting adjustment

Question:

How can the amount of available preheating oxygen be determined when doing oxy-liquified petroleum gas flame-cutting?

Answer:

For maximum efficiency in oxy-LP gas flame-cutting preheat flames require five volumes of oxygen to one volume of LP gas. While this gas ratio may seem difficult to obtain, there are three methods of accurately determining such a ratio.

1—Minimum Cone Length: Open the fuel gas needle valve and ignite gas, pressing tip lightly at a 45-deg angle against fire brick or metal. Turn on oxygen preheat valve and inner cones will snap back so that combustion starts in the recessed cup. Lift torch head and gradually increase oxygen volume. Inner cones will become progressively shorter as oxygen supply is increased until the flames reach their shortest point, then begin to elongate. The proper adjustment is the shortest length of cone.

2—Water Bucket Test: Fill a pail with water to within 4 in. of the top. Light and adjust torch as described above. Gently immerse tip into the water to a depth of, say, 2 in. The flame will burn under water. If insufficient oxygen is being supplied, those gases which have not been combusted will burn with air on the surface of the water. Slowly increase oxygen adjustment until burning of the gases above the water ceases. This is the proper adjustment.

3—Black Spots on Preheated Surface: Adjust preheat as described above. Apply preheat to clean surface of steel (not on the edge). Hold tip so that ends of the inner cones of flames just touch the surface. As the temperature rises, a bright cherry spot will glow on the steel under each preheat cone. If insufficient oxygen is supplied, a small black spot will appear in the center of each bright spot. Slowly increase oxygen adjustment until the black spots vanish. This is the proper adjustment.

The three methods cited are exact, simple to master, and they triple-check each other. As the operator gains experience, he will quickly learn to use one particular method, but he can always verify his judgment by cross-checking with others.

Question:

What are the advantages of oxy-LP gas for flame-cutting?

Answer:

In flame-cutting, preheat flames from the cutting tip raise the temperature of steel to a critical point (a cherry red or approximately 1,650 F). At such a temperature steel will burn in an atmosphere of air. Thus, the oxy-LP gas mixture will prove quite satisfactory though flame temperature is lower than that of the oxyacetylene flame.

Preheating time required to start a cut is somewhat longer, possibly three to five seconds, than with oxyacetylene. This depends upon whether the cut is started on the edge of the plate, inside, or piercing the face of the plate. Another factor affecting starting time is cleanliness of the surface being preheated.

Once the cut has been started, advantages are all in favor of oxy-LP gas. Because of the gentler, lower temperature flame, edges of the cut are not overheated and a narrower kerf of metal is burned away.

This action means that less cutting oxygen is required since a lesser volume of steel is removed. Conversely, it will allow the same volume of cutting oxygen to more completely oxidize displaced metal, depending upon the speed at which the torch is advanced.

This minimizes slag adherence to the underside of the kerf. When present at all, however, the slag is quite brittle and easily removed. Another advantage is that lower preheat temperatures do not melt the cut edge.

Question:

Is there a maximum limit on the amount of acetylene that can be drawn on a cylinder in a given period of time?

Answer:

If an acetylene cylinder is discharged too rapidly, a certain proportion of acetone will be drawn out with the gas in the form of an acetone vapor. Experience and numerous experiments have proved that if the flow of gas from an acetylene cylinder is kept within certain limits, the amount of acetone drawn off is negligible.

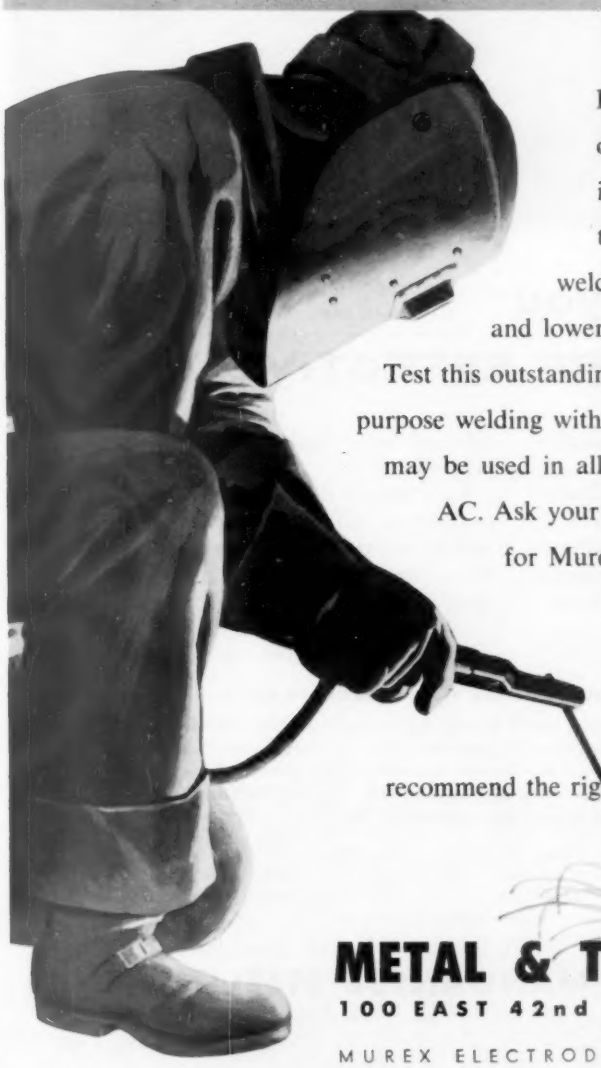
For this reason, maximum gas flow from an acetylene cylinder should not exceed 1/7 of the cylinder capacity within one hour. This means that an acetylene cylinder should not be discharged in less than seven hours actual working time.

If welding or cutting operations to be undertaken require a greater gas consumption than the above figure, it is recommended that two or more cylinders be connected in series or to a manifold so that all cylinders may be turned on at the same time.

15 Good Reasons Why

GENEX M can improve your E-6012 welding

SMOOTH ARC	WIDE CURRENT RANGE	GOOD ROOT BEAD CONTOUR
STEADY ARC	OUTSTANDING ON AC	PLEASING SURFACE APPEARANCE
MINIMUM SPATTER	GOOD WETTING ACTION	EASY TO USE ON VERTICAL DOWN
EASY TO RE-STRIKE	EXCELLENT FILLET CONTOUR	GOOD ON LIGHT GAUGE
NO CHANGE AS ROD IS CONSUMED	WELL-SHAPED COVER BEADS	READILY BRIDGES GAPS



Right across the board—the characteristics of all Murex Genex M qualities add up to improved welding at lower cost because they mean greater operator appeal, higher weld quality, fewer rejects, speedier welding and lower cost.

Test this outstanding electrode yourself. Designed for general purpose welding with poor fit-up on all E-6012 applications, it may be used in all positions on DC straight polarity, or on AC. Ask your nearest M&T representative or distributor for Murex Genex M electrodes—You will like the way they handle, and be amazed at the results.

There is a Murex electrode for *every* welding use. Ask your M&T man to recommend the right electrode for your next job.

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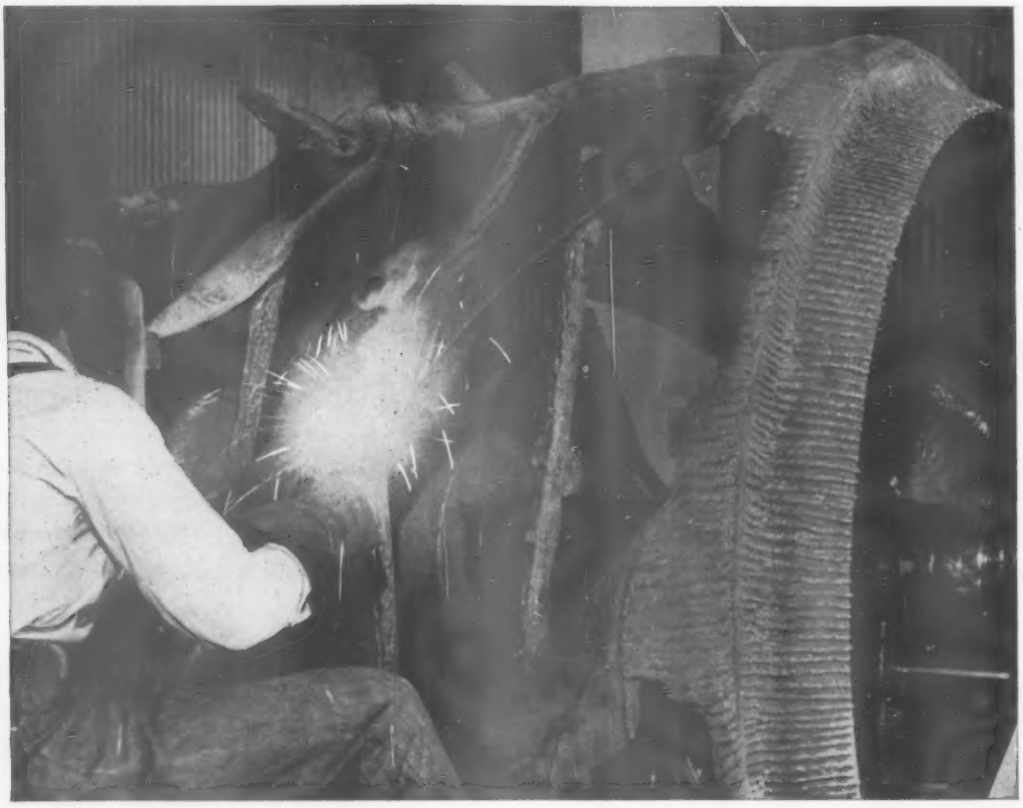

How AMSCO® helps you HARDFACE MORE EFFECTIVELY

The complete line of 15 Amsco hardfacing rods represents a selection of the toughest, hardest alloys available. Among the metals used for alloying are these highly wear-resistant elements—manganese . . . chromium . . . nickel . . . cobalt . . . tungsten . . . molybdenum. Each has particular resistance to certain types of wear—including impact, abrasion, heat, corrosion.

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AMERICAN Brake Shoe COMPANY

AMERICAN MANGANESE STEEL DIVISION
Chicago Heights, Ill.

Weight of weld metal

FORMULAE

electrode cost per foot of welding

$$\frac{C \times W}{E}$$

power cost per foot of welding

$$\frac{P \times V \times A \times W}{100 \times R \times T}$$

labor cost per foot of welding

$$\frac{L \times W}{R \times T}$$

total cost per foot of welding

$$W\left(\frac{C}{E}+\frac{L}{R \times T}+\frac{P \times V \times A}{1000 \times RT}\right)$$

TABLE 1 WEIGHT OF DEPOSITED WELD METAL (LBS. PER FT.)—BUTT WELDS

B							T	A									
1/2"	3/8"	5/16"	1/4"	3/16"	5/32"	1/8"		10°	15°	20°	25°	30°	35°	40°	45°	50°	60°	90°
.31967	.23958	.19971	.15984	.11996	.09985	.07975	3/16"	.01050	.01578	.02113	.02655	.03210	.03783	.04362	.04976	.05589	.06918	.11996
.42600	.31967	.26616	.21300	.15984	.13325	.10667	1/4"	.01864	.02805	.03749	.04737	.05691	.06714	.07770	.08827	.09917	.12303	.21300
.53267	.39942	.33296	.26616	.19971	.16631	.13325	5/16"	.02914	.04396	.05862	.07395	.08929	.10497	.12098	.13802	.15506	.19221	.33296
.63900	.47916	.39942	.31967	.23958	.19971	.15984	3/8"	.04192	.06305	.08452	.10633	.12848	.15097	.17449	.19835	.22356	.27673	.47916
.74567	.55925	.46587	.37284	.27946	.23311	.18642	7/16"	.05691	.08588	.11485	.14450	.17483	.20550	.23754	.27025	.30399	.37658	.65229
.85200	.63900	.53267	.42600	.31967	.26616	.21300	1/2"	.07464	.11212	.15029	.18880	.22834	.26855	.31013	.35307	.39737	.49212	.85200
1.06500	.79884	.66558	.53267	.39942	.33296	.26616	5/8"	.11655	.17517	.23481	.29513	.35648	.41987	.48462	.55141	.62060	.76850	1.33120
1.27800	.95867	.79884	.63900	.47916	.39942	.31967	3/4"	.16767	.25253	.33807	.42498	.51359	.60458	.69796	.79406	.89392	1.10692	1.91700
1.49100	1.11816	.93175	.74567	.55925	.46587	.37284	7/8"	.22834	.34353	.46008	.57834	.69898	.82269	.94981	1.08068	1.21666	1.50668	2.60916
1.70400	1.27800	1.06500	.85200	.63900	.53267	.42600	1"	.29820	.44883	.60083	.75555	.91300	1.07454	1.24051	1.41159	1.58915	1.96778	3.40800
1.91700	1.43784	1.19825	.95867	.71875	.59913	.47916	1 1/8"	.37727	.56811	.76032	.95628	1.15565	1.35979	1.57007	1.78647	2.01106	2.49057	4.31316
2.13000	1.59767	1.33116	1.06500	.79884	.66558	.53267	1 1/4"	.46587	.70137	.93890	1.18053	1.42659	1.67912	1.93847	2.20566	2.48307	3.07470	5.32500
2.55600	1.91700	1.59767	1.27800	.95867	.79884	.63900	1 1/2"	.67104	1.00979	1.35195	1.69991	2.05434	2.41764	2.79115	3.17626	3.57567	4.42767	7.66800

If T = 1", B = 1/2" & A = 60°. For T = 1" & B = 1/2" table value is 1.70400. For T = 1 & A = 60° table value is 1.96778 so weight = 1.70400 + 1.96778 = 3.67178 lbs. per ft.

TABLE 2 TOTAL WEIGHT (LBS. PER FT.) OF DEPOSIT INCLUDING

A							T	W									
1/2"	3/8"	5/16"	1/4"	3/16"	5/32"	1/8"		10°	15°	20°	25°	30°	35°	40°	45°	50°	60°	90°
.42617	.31956	.26631	.21314	.15992	.13313	.10595	3/16"	.01749	.02628	.03522	.04424	.05349	.06303	.07267	.08283	.09309	.11533	.19986
.53250	.39965	.33276	.26630	.19980	.16653	.13287	1/4"	.02796	.04205	.05624	.07096	.08541	.10074	.11642	.13240	.14877	.18453	.31950
.63917	.4794	.39956	.31916	.23967	.19959	.15945	5/16"	.04077	.06146	.08207	.10345	.12494	.14697	.16938	.19315	.21706	.26911	.46616
.7455	.55914	.46602	.37297	.27954	.23299	.18604	3/8"	.0559	.08405	.11268	.14173	.17128	.20137	.23269	.26455	.29796	.36898	.63906
.85217	.63923	.53247	.42614	.31942	.26639	.21262	7/16"	.07322	.11043	.14770	.1858	.22473	.2643	.30529	.3475	.39079	.48428	.83879
.9585	.71898	.59927	.4793	.35963	.29944	.2392	1/2"	.09325	.14012	.18788	.2360	.28544	.33575	.38763	.44132	.49657	.61512	1.0650
1.1715	.87882	.73218	.58597	.43938	.36624	.29236	5/8"	.13980	.21017	.28171	.35413	.42788	.50387	.58142	.66161	.74450	.92240	1.39932
1.3845	1.03865	.86544	.69230	.51912	.43270	.34587	3/4"	.19562	.29453	.39442	.49578	.59919	.70548	.81406	.92626	1.04272	1.29142	2.2369
1.5975	1.19814	.99835	.79897	.59921	.49915	.39904	7/8"	.26094	.39253	.52578	.66094	.79888	.94029	1.08531	1.23508	1.39026	1.72188	2.98216
1.8105	1.35798	1.1316	.90530	.67896	.56595	.45220	1"	.33540	.50483	.67601	.84995	1.0272	1.20894	1.39551	1.58809	1.78755	2.21378	3.834
2.0235	1.51782	1.26485	1.01197	.75871	.63241	.50536	1 1/8"	.41917	.63511	.84492	1.06238	1.28415	1.51109	1.74427	1.98497	2.23406	2.76707	4.79316
2.2365	1.67765	1.39776	1.11830	.83880	.69886	.55887	1 1/4"	.51247	.77137	1.0328	1.29863	1.56949	1.84712	2.13227	2.42616	2.73097	3.3826	5.858
2.6625	1.99698	1.66427	1.3313	.99863	.83212	.6652	1 1/2"	.72694	1.0938	1.46472	1.84151	2.22564	2.61924	3.02365	3.44101	3.87327	4.79667	8.307

Weights of weld metal required for standard butt welds, with various included angles and root gaps, are shown in Tables I and II.

Table I applies to welds without cover beads. Table II applies to welds with cover beads.

(Courtesy Metal & Thermit Corp.)

Save 28% on Welding Ignitrons!

G-E REMANUFACTURED IGNITRON EXCHANGE GIVES YOU NEW-TUBE LIFE AT NEW

A G-E "first"! Cuts your replacement costs sharply! *Only* General Electric brings you the new Remanufactured Ignitron Exchange Plan, whereby you obtain reliable ignitron replacements at substantial savings . . . with no compromise in quality.

Remanufactured ignitrons come to you at prices much lower than new tubes. Savings average 28% on the three ignitron types now being remanufactured—GL-5551, GL-5552, GL-5553-A. And remember: General Electric's new-tube warranty on remanufactured ignitrons assures you of new-tube performance!

The special remanufacturing process replaces all cathode elements—ignitor, mercury pool, etc. These are the elements most subject to breakdown after long service. The stabilized-steel jacket and other parts are fully utilized in the remade tube for your benefit. Result: a priced-for-saving ignitron tube that will perform up to new-tube standards.

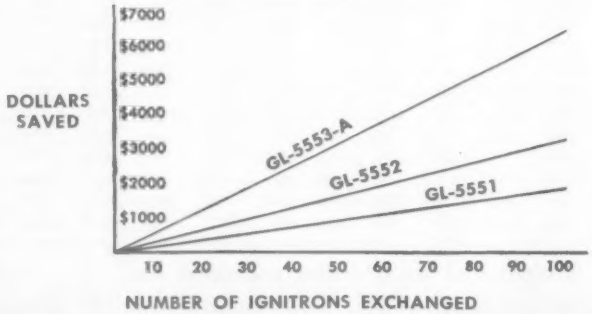
You lose no time from delivery delays. Remanufactured ignitrons are stocked right at your local G-E tube distributor's. Supply him with one exchangeable G-E tube and receive on the spot a low-cost remanufactured ignitron. It's as easy as that!

Phone your G-E tube distributor today! Ask him to explain how you can make ignitron savings never possible before! *Tube Department, General Electric Company, Schenectady 5, New York.*

SAVING PER TUBE

TYPE	DOLLARS SAVED	% PRICE SAVED
GL-5551	$17.90	27%
GL-5552	28.50	28%
GL-5553-A	63.00	29%

HOW YOUR SAVING INCREASES WITH NUMBER OF IGNITRONS EXCHANGED



PLAN
LOW PRICES!

ALL-NEW CATHODE ASSEMBLY

Every G-E remanufactured ignitron gets a complete new cathode assembly, no matter what the condition of the tube. Cathode parts are the components most subject to wear and breakdown after long, hard service. Key new parts supplied are:

NEW IGNITOR

NEW MERCURY SUPPLY

STABILIZED-STEEL JACKETS—A G-E "PLUS"!

Stabilized stainless-steel water jackets are exclusive with G-E ignitrons. They explain why General Electric alone can offer you remanufactured ignitrons with new-tube performance. Only *stabilized* steel will undergo a second high-temperature baking with no corroding after-effects!

G-E NEW-TUBE WARRANTY GOES WITH EACH REMANUFACTURED IGNITRON!

General Electric's Remanufactured Ignitron Exchange Plan provides a standard new-tube warranty with each remade G-E ignitron tube. This is your assurance of new-tube performance.

Each remanufactured G-E ignitron has been thoroughly tested under the same conditions as new tubes. To be approved for your use, the remade ignitrons are required to perform at new-tube ratings and satisfy the highest quality standards.

You can be sure of optimum performance and reliability with remanufactured General Electric ignitron tubes!

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GENERAL ELECTRIC

161-101

AIRCO
WELDING and BRAZING Hints

PROBLEM:

To gas weld steel

SOLUTION:

Airco #1 Alloy Steel Rod. Designed for welding low carbon and low alloy steels. Provides high ductibility in "as welded" condition when welding with a neutral flame or with a slight excess of acetylene. It is smooth flowing, insuring good control of molten pool. Recommended for all general pipe and plate welding, aircraft structures and maintenance work.

Airco #4 High Tensile Welding Rod. Whenever current codes and product specifications allow the use of a lower priced, high strength rod, Airco #4 will meet all specifications. This rod is for producing welds in low alloy steel requiring minimum tensile requirements of 62,000 psi.

Airco #7 Mild Steel Rod. This low priced general purpose welding rod is popular in job shop and maintenance work for welding low carbon steel. In using this rod it is suggested that the weld metal pool be worked so as to include a fair amount of base metal in the mixture.

Send for this free catalog!
You'll find here the finest rods and fluxes for joining both ferrous and non-ferrous metals. Write Airco at address below.

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new products... card on page 89

HORIZONTAL welder was developed to conserve floor space and aid in stacking and parallelling.

Welder

RECTIFIER d-c welder is horizontal rather than upright in design. Termed "SRH," welder was developed to conserve floor space and facilitate stacking and parallelling.

Welder has single current range. Three models with 60% duty cycle ratings of 200, 300 and 400 amp are available. Case is weatherproof; can be used outdoors. *Miller Electric Mfg. Co., Inc.*

Circle No. 1.

Arc cutting torch

TORCH is designed for arc cutting and gouging. For use in heavy duty work, it has impact-resistant molded jaw insulators and silicone glass sleeve to protect upper end of handle from heat. Torch can use up to 5/8-in. diameter electrodes.

Termed "G-5," torch operates from d-c welding machine and compressed air line. Rotating nozzle permits adjustment of electrode angle. Air and current are brought to torch through concentric cable, allowing flexibility. *Arcair Co.*

Circle No. 2.

Hardfacing

ALLOY for hardfacing, "Colmonoy No. 70," is said to give wearproof, corrosion-resistant surface. It has a high tungsten content which hardens the matrix, giving it improved heat and vibration-resistant properties.

A nickel-chromium-boron-tungsten hardfacing alloy, "No. 70" is available as powder or welding rod. Powder is for use with spray welding. Rod, in 3/16, 1/4, 5/16 and 3/8-in. diameters, is for application with oxy-acetylene torch. Alloy also comes as castings. Surface hardness ranges from 50 to 55 Rockwell C; melting point is 2,000 F. *Wall Colmonoy Corp.*

Circle No. 4.

Plastic lining

PLASTIC laminate, fluorocarbon type, is claimed to have high temperature and extreme chemical resistance. The "Kel-F" laminate consists of a thin, continuous layer of plastic on glass cloth. It can be adhesive-bonded to almost any contoured surface, including rectangular plating tanks and complex reactors.

To apply surface must be cleaned and roughened. Adhesive is applied to both laminate and supporting surfaces. Laminate is available in sheets 36 by 46 in. Sheets can be cut with knife or hot- or cold-formed to surface. *M. W. Kellogg Co.*

Circle No. 5.

Tig torch

AIR-COOLED torch is for Tig (tungsten inert-gas) welding of light metals. The "HW-17" torch has continuous-duty current capacity of 130 amp. It can join mild steel and hard-to-weld metals and can handle jobs formerly requiring a water-cooled torch.

Torch is equipped with either 12½ or 25 ft of cable and argon hose. Without cable and hose, torch weighs 4.8 oz. Overall length is 7-13/16 in.; handle diameter is ¾ in. Twist of torch cap adjusts electrodes. Torch operates on a-c; straight or reversed polarity d-c. *Linde Air Products Co.*

Circle No. 6.

This 90° bend test proves

NEW Mang-Arc

Nickel-Manganese Electrodes

build tough welds!

Test specimen is ¾" manganese plate with v-butt welded joint. Bare ⅛" Mang-Arc Nickel-Manganese Electrodes were used for the butt weld. Specimen was then machined by grinding and put in the testing machine. A full 90° bend was made before cracks appeared on the surface of the welded joint.

NEW Mang-Arc electrodes are made of fabricated *precision drawn wire* by new manufacturing techniques that give you the important advantage of excellent weldability and extra tough welds at lower cost!

Mang-Arc electrodes are available bare or coated. Find out how this new Alloy Rods development can save you money. Write for illustrated bulletin on new Mang-Arc Nickel-Manganese Electrodes today.

Alloy Rods Co.

General Offices and Plant
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Pacific Coast Sales Offices and Plant
El Segundo, California

no finer electrodes made...anywhere

When welding stainless...and corrosion resistance is a "must"

WELD WITH ARCOS

STAINLESS ELECTRODES

Welds on a catalytic cracking unit such as this are continually subjected to corrosion, pressure and high temperatures. They must be perfect—faulty welds will result in failure and costly downtime. That's why it pays to specify ARCOS Stainless Electrodes. Quality controlled in manufacture, they assure sound weld metal for long-term dependability under continual use and the severest conditions. ARCOS CORPORATION, 1500 South 50th Street, Philadelphia 43, Pa.

Ignitron

CONVERTIBLE ignitron, for use with or without temperature control, is claimed to eliminate double-stocking tube types. The three models of ignitrons (welding and power conversion tubes) are "GL-5551-A," "GL-5552-A" and "GL-5553-B."

Thermostat is clipped to a slotted copper plate. Replacement is done by attaching thermostat to new tube. "GL-5551-A" is rated at 40 amp; "GL-5552-A" at 140 amp, and "GL-5553-B" at 335 amp. *General Electric Co.*

Circle No. 7.

Protective curtain

MADE from impregnated canvas, flame-resistant curtain provides protection from intense heat, arc flash, flying chips and scale. Curtain can screen off arc welding operations. It can also be made into booths to screen off other dangerous operations.

Curtain is available in sizes up to and over 100 sq ft. Seams are double row stitched; all edges are hemmed with brass grommets. *Eastern Equipment Co., Inc.*

Circle No. 8.

Power rectifier

OCCUPYING a volume of 190 cu in., small, compact 30 kw liquid cooled germanium power rectifier is for a-c to d-c conversion. It is for use where high power output, high efficiency and small unit size is needed.

Rectifier can be utilized for all types of d-c requirements, except those requiring heavy surge currents and those subject to heavy intermittent overloads. Unit operates over temperature range of —55 to +75 C, when equipment operates within specified ratings. *International Rectifier Corp.*

Circle No. 9.

Metallizing gun

SIMPLIFIED air governor control is feature of "Vanco" metallizing gun. Air turbine provides power control uniformly feeding metal wire without fluctuation. Other features are self-contained gas mixing chamber nozzle eliminating backfire and light weight construction. *Vandersee Corp.*
Circle No. 10.

Spatter proofing

COMPOUND is said to be capable of reducing welding cleaning time by preventing spatter adherence. "Improved Spatternix No. 1" dries in 90 to 120 seconds. It is also a rust preventive.

It can be painted over without detrimental effects to the paint. Available in 1- to 5-gal cans or 55-gal drums. *Johnson Welding Equipment*
Circle No. 11.

Flame-cutting

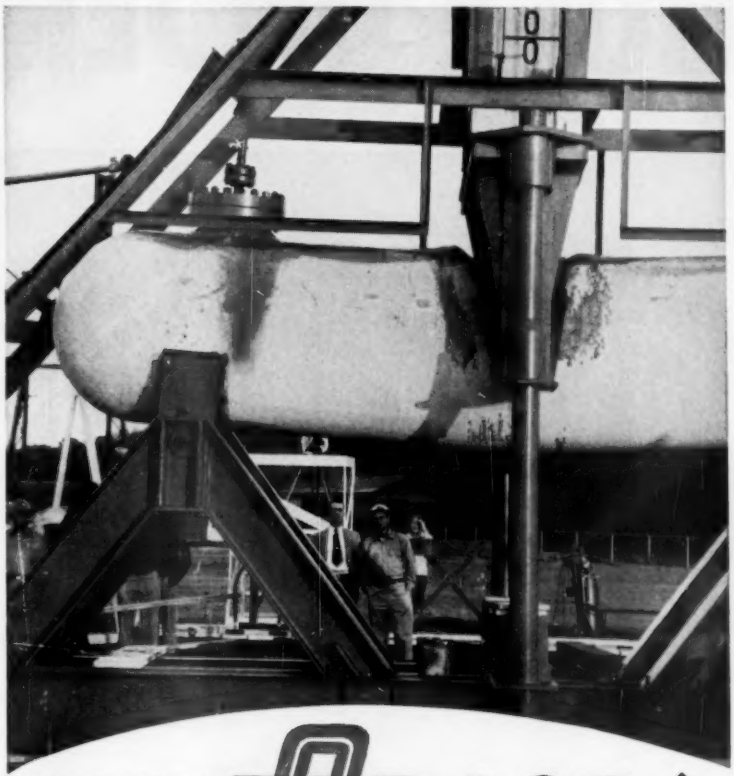
MACHINE is designed for flame-cutting round holes in pressure vessels, exchangers, tanks and large pipe. Known as "D Hole-O-Graph," machine will cut holes to 120 in. diameter. Hole size is adjustable from 2 to 24-in. diameter.

Cutting torch and elevating mechanism are electrically controlled. Machine is available with portable roller base, rail car mounting or for permanent stationary installation. *Vernon Tool Co., Ltd.*
Circle No. 12.

Brazing flux

FLUX is for high temperature brazing of chrome and nickel alloys. It is said to be free-flowing and active in temperature range of 1,400 to 2,000 F. Recommended applications are stainless steel assemblies used in jet aircraft, automotive, pharmaceutical and nuclear energy industries. *Air Reduction Sales Co.*
Circle No. 13.

Proof of how to weld Constructional Alloy steels for maximum strength



WELD WITH ARCOS

LOW HYDROGEN ELECTRODES

The above test vessel* was welded with ARCOS Low Hydrogen Electrodes without stress relieving. After being refrigerated to −33°F, and pressurized to 1,875 p.s.i., a 13-ton ingot was dropped on it from 73 ft. All steel and welds remained intact—proof of how Arcos weld metal can meet the severest requirements of strength, low temperature impact, and pressure. ARCOS CORPORATION, 1500 South 50th Street, Philadelphia 43, Pa.

*Made of USS "T-1"—new super tough alloy steel developed by U. S. Steel. Test conducted jointly by Chicago Bridge & Iron Co. and U. S. Steel.

HUGE UNDERWATER

PREFABRICATING TUNNEL SECTIONS—Shown above is just one of 460, 15-ft. tunnel units being assembled in the Eddystone, Pa. shops of Baldwin-Lima-Hamilton. These units will be welded into twenty-three 300-ft. long tube sections, floated to the site, sunk and welded together to form one 6,900-ft. long underwater traffic tunnel. The welding fixture, an engineering feat in itself, was designed and built by Baldwin-Lima-Hamilton for this specific job. At the top of this photograph are shown several of the A. O. Smith DC rectifiers used in this project.

TRAFFIC TUNNEL

A. O. Smith electrodes used for over 910,000 ft. of welds. Baldwin-Lima-Hamilton tackles tough Hampton Roads tunnel contract ... uses SW-10's, SW-15's, SW-44's, and SW-35's for the manual welds.

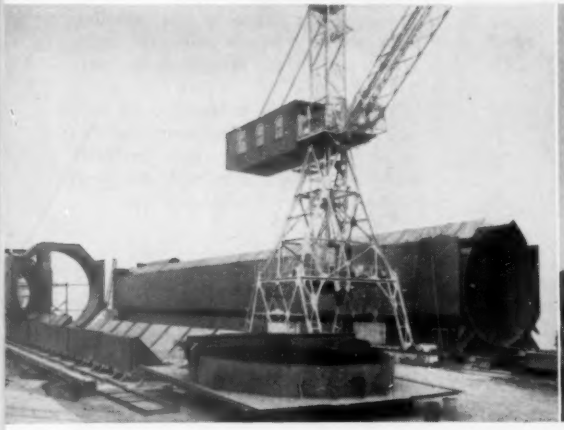
On a job this tough, Baldwin-Lima-Hamilton Corp., Philadelphia, Pa. knew there could be no margin for error. They specified A. O. Smith electrodes for the manual welding.

The work involved pre-fabricating 15-ft. double-shelled tunnel sections and welding them together to form one huge 300-ft. tube section 33 ft. in diameter. The larger sections have concrete poured between the shells, and cofferdams or bulkheads welded over the open ends. Twenty-three 300-ft. sections will be floated to the site and sunk in position to form the 6,900-ft. underwater tunnel.

Upon completion of the contract — which also includes construction of better than a mile and a half of approaches—more than 215,000 lbs. of A. O. Smith electrodes will have been used. Specifically — over 45,000 lbs. of SW-10 (E-6010) . . . 30,000 lbs. of SW-35 (E-6020) ... 95,000 lbs. of iron powder SW-44 (E-6024) ... and 45,000 lbs. of SW-15 (E-6013).

Mr. Frank Iapalucci, director of welding on the project, specified A. O. Smith electrodes. He knows A. O. Smith electrodes give him quality and uniformity . . . welds that are right the first time . . . top production at lowest overall costs.

If your job demands top quality welds every time, talk to your A. O. Smith representative. Or — write to A. O. Smith Corporation, Welding Products Division, Milwaukee 1, Wisconsin.



At left side of photo, complete 15-ft. sections, with concrete already poured between inner and outer shell, rest in shipway. There they will be welded into large 300-ft. section as shown on the right.

Frank Iapalucci, Baldwin-Lima-Hamilton's director of welding, and Dave Buerkel, A. O. Smith welding representative, compare scale model tunnel section with blueprints to determine welding needs.

PRODUCED BY WELDERS — FOR WELDERS
Because welding is our full-time business, we can offer you America's finest welder-proved electrodes, machines and accessories.

Through research A.O. Smith *... a better way*

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Milwaukee 1, Wisconsin
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Gasweld
TORCHES and REGULATORS
Matched Masterpieces
Gasweld R-90 Series
2-stage performance, single stage cost! Maintains stable gas pressure from full to empty cylinder without resetting. New "capsule" control unit permits fast "on-cylinder" repairs.
Gasweld Model WG-25
"O" ring assembly for fastest switch from welding to cutting. Hand tightening gives gas-tight seal. Precision, bump-proof needle valve flame adjustment. Anti-flashback mixing chamber.

"Made for each other"

When you combine the advantages of Gasweld torches and regulators—you've reached the limit. Beautifully precision made, yet job-tough and long wearing, a Gasweld team is a welding wonder! See the complete line at your dealer's — or write for catalogs and prices.

LIQUID also produces Oxygen, Acetylene and other commercial gases including CO_2 in all its forms—Gas, Liquid and Solid (Dry Ice) for industrial use.

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West of the Rockies: STUART OXYGEN CO., Los Angeles • In Canada: IMPERIAL OXYGEN LTD., Montreal

Magnetic plate clamp

WELDING clamp is light, self-contained unit, combining powerful magnetic base and fast operating jack. Designed as aid to welding of heavy metal plates, it can be used by one weldor.

The "Porto-Magnetic" plate clamp is first placed with jack over plate. Fingertip turns ratchet lever for alignment. Clamp is said to eliminate supporting clamps or driving wedges. For normal welding, clamp has flat base; contour shoes are available for welding curved surfaces. Unit has magnetic grip with lifting power of 3,000 lb on direct pull. *Portomag Sales, Inc.*

Circle No. 14.

Nylon bond

ADHESIVE requires no curing and is said to possess good strength characteristics. Made of nylon, "Nylosil," has high resistance to oils, alkalies, bleaches. Bonds are effective under wide temperature ranges, states manufacturer.

Feature of new adhesive is its ability to fill gaps resulting when surfaces to be jointed are not perfectly matched. Available in wide range of viscosities. *Ions Exchange Corp.*

Circle No. 15.

Spectacle cleanser

THROWAWAY goggle cleaning station, "Stops Fog," is a self-contained unit. It houses an anti-fog and cleaner solution, wiping tissue and used tissue disposal space. Solution is said to both stop fog and clean in one application.

Solution is dispensed by plunger attached to unbreakable bottles. Tissues are dispensed from beneath unit; are used to wipe and polish goggles. Unit with wall bracket is thrown away when liquid and tissues are gone. *Pulmosan Safety Equipment Corp.*

Circle No. 16.

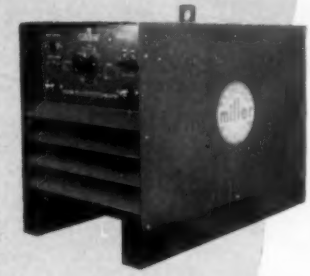
For more information use card on page 89

NO SINGLE WELDER WILL DO IT ALL!

THERE'S EXACTLY
THE RIGHT **miller** WELDER
TO MEET EVERY WELDING REQUIREMENT

MILLER SR RECTIFIER TYPE DC ARC WELDERS

Available in 200, 300, 400 and 600 amperes, it is a superior direct current welder using Miller Unitron transformer control and selenium rectifiers for conversion from 3 phase AC line current. Miller SR Welders feature widest possible current range, extreme arc flexibility, maximum electrode deposition rate and highest electrical efficiency.



THE *New* MILLER SRH RECTIFIER TYPE DC ARC WELDER

A new concept in welder design for all DC metalic arc welding. Available in 200, 300 and 400 amperes. It is ruggedly constructed, compact, and is designed to lend itself to stacking for parallel operation or to conserve floor space. It has single range control and is weatherproof.

MILLER ARC WELDERS FOR TUNGSTEN ARC WELDING PROCESS

These Miller Welders feature the patented Miller UNITRAN control circuit which combines the transformer with its own integral flux diverter. This, in conjunction with adequate open circuit voltage, high frequency, balancing resistor and optional controls insures superior uniformity and flexibility throughout the entire welding range. Available in nine models.

THE *New* MILLER MULTI ARC COMBINATION AC-DC WELDER

Available in 14 models, this new Miller Welder provides both AC and DC welding power for applications where both are required. It operates from a single phase power line and is available with high frequency and controls designed especially for inert gas arc and spot welding.

MILLER 100 SERIES HEAVY DUTY INDUSTRIAL TYPE AC WELDERS

Designed for heavy production welding and automatic welding applications. Available in eight models. The 100 Series Welders permit faster welding—as much as 35% faster. Movable coil design and 80 volts O.C.V. produces uniform and better welding characteristics throughout the entire range of the welder.

Write today for complete information on these Miller Welders.

ARC-SPOT miller GENERATORS WELDERS

miller

ELECTRIC MANUFACTURING CO., INC.

P.O. Box 798 Appleton, Wisconsin

"... if it's MILLER you know it's the finest..."

Before you jump into production

remember

L-T* Brazing steel saves money

UNITED SIL-BOND assures *Quality*

If you are a cost-conscious manufacturer, you should know:

Brazing cuts steps, saves time, assures a better looking, longer lasting steel joint.

If assured quality as well as cost counts with you, you should know:

United SIL-BOND works fast, flows neatly, brazes a smooth, clear, strong, highly ductile joint that never requires grinding or finishing.

Before designing for expensive machine hours, consider L-T* Brazing of low-cost stampings and screw machine parts.

*Low Temperature

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JOIN BETTER BY BRAZING • JOIN BEST WITH SIL-BOND!

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BOOTH 23

WELDING SHOW

MEMORIAL AUDITORIUM

BUFFALO, N. Y. • MAY 9-11, 1956

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AND SUPPLY CORPORATION

Brazing Alloy Division

1497 ELMWOOD AVENUE, PROVIDENCE 7, R. I.

Look to United for the best in Aluminum, Copper and Brass Tube and Wire

Weld tester

INSTRUMENT for measuring iron content in stainless steel weld is termed "elcometer." Designed for rapid indication of iron content at various points along a weld, "elcometer" is a non-destructive tester.

Indicator operates on principle that increase of magnetic flux intensity between two soft iron test probes of a U-shaped magnetic circuit reduces forces on a spring-loaded magnetic needle in a parallel magnetic branch. Tension of spring can be adjusted to give needle scale reading corresponding to iron content of standard reference sample. Instrument is pocket-size. *Ferro Corp.*

Circle No. 17.

Magnetic-flux welder

COMPACT and portable, "MF" semi-automatic welder is recommended for manganese steel and hardfacing of irregular parts. The welder, mounted on large casters, is designed to plug into conventional a-c or d-c welding units by single cable. It operates on current range of 150-450 amp.

Welding wire is fed automatically through a flexible cable at rate governed by size of welding arc; flux is fed through cone-shaped hopper above weld contact. Flux adheres magnetically to welding wire. Weldor saves time by merely changing flux in hopper for either welding or hardfacing applications. The welding wire remains the same. *American Brake Shoe Co.*

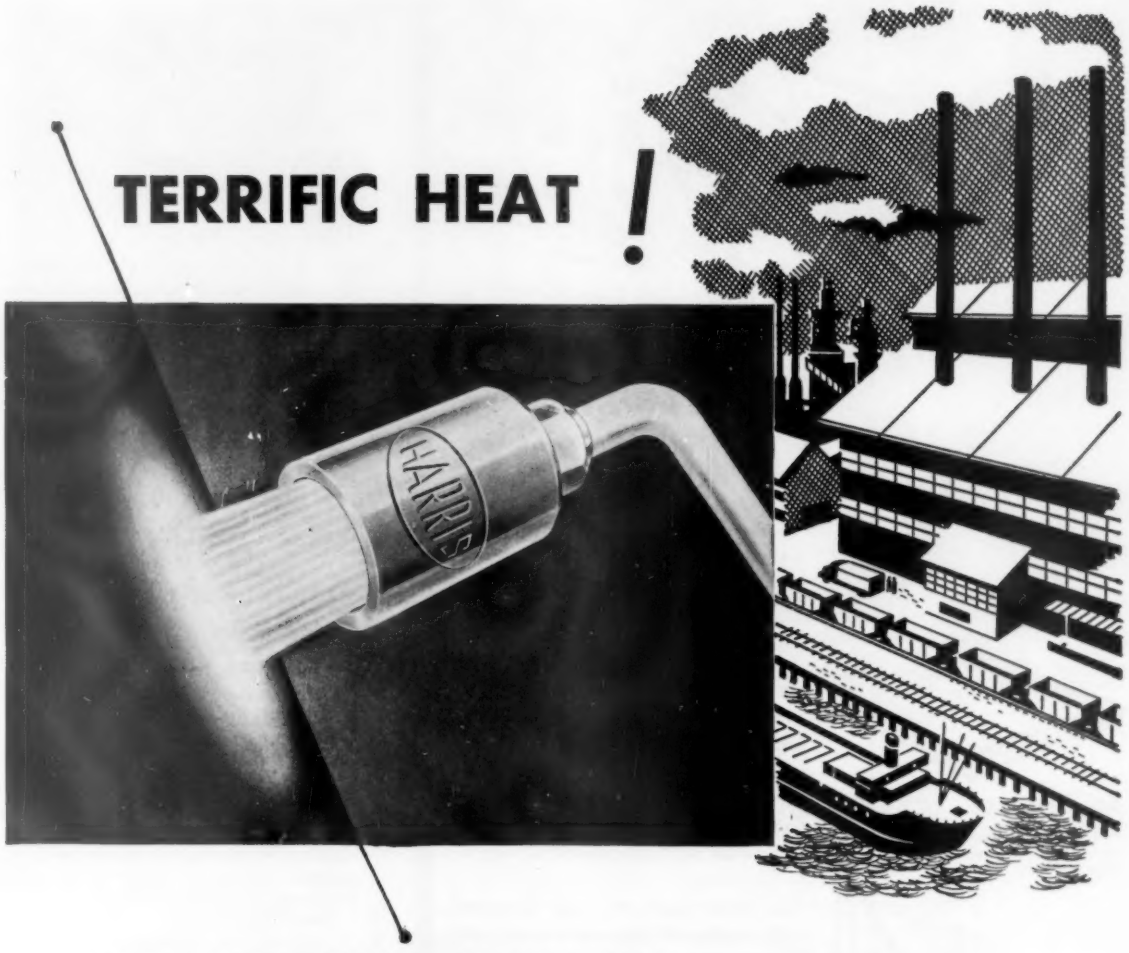
Circle No. 18.

Welding tools

WOOD grip has been developed for steel shafted "Tomahawks" and "Dual Tools." Grip is egg-shaped to fit hand and line up the chipping edge. It is belled slightly toward the end to prevent tool slipping out of the hand. The metal coil handle is still available on all models. *Atlas Welding Accessories Co.*

Circle No. 19.

TERRIFIC HEAT !



HARRIS SUPER-HEAT TORCH NO. K23

Heat is the Prime Factor utilized in connection with innumerable Metal Working Operations. While it is a fact that the Oxy-Acetylene Welding Torch is universal in its applications, there are many Operations requiring a much greater volume of Intense Heat than can be obtained from a Welding Torch.

A definite limitation exists relative to the amount of Oxygen and Acetylene Gases which can be safely mixed without danger of the Flame "Back-firing", due to the extremely fast Flame Propagation Characteristics of such Gas Mixtures. On the other hand, much larger volumes of such Fuel Gases as Propane, City Gas and Natural Gases can be safely mixed with Oxygen on account of their lower rate of Flame Propagation. It is evident the larger the volume of Gases mixed, the greater the Flame and resulting Heating Value. This produces the truly phenomenal results achieved by this Harris Super-Heating Torch.

The applications of this Harris Torch are unlimited, where large volumes of Intense Heat are required, either as a Portable or Stationary Unit. In places where Massive Shafts are to be Straightened; Large Size Pipe Bent; Flanging or Straightening of Steel Plates; Brazing Heavy Copper Pipe, etc., etc., this Harris Torch, with its **TERRIFIC HEAT**, is the answer.

HARRIS 1905 50 1955 ANNIVERSARY

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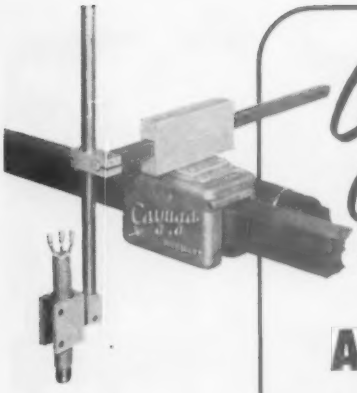
THE HARRIS CALORIFIC COMPANY
CLEVELAND 2, OHIO



Look to Cayuga for the best in

AUTOMATIC WELDING EQUIPMENT

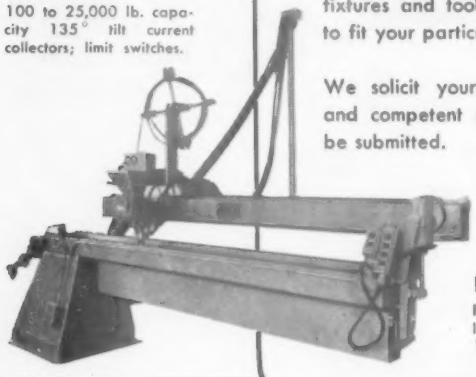
SEAMER
A complete self contained portable unit, 5' - 20' long.

POSITIONER
100 to 25,000 lb. capacity 135° tilt current collectors; limit switches.

Cayuga builds a **complete** line of standard automatic welding equipment. Whether you need a single unit or a complete fabrication line, come to Cayuga.

We design, build and sequence all phases of the handling and welding operations, both mechanical and electrical. Automatic techniques, special fixtures and tools will be developed to fit your particular needs.

We solicit your inquiries. Qualified and competent recommendations will be submitted.



HORN JIG
For cylinders or rectangular tanks from 3' - 20' long, 1' to 20' diameter.

- HORN JIGS
- TRAVEL CARRIAGES
- TURNING ROLLS
- TURN TABLES
- WIRE REELS
- PEDESTALS
- POSITIONERS
- BEAMS

Cayuga

- DESIGNERS
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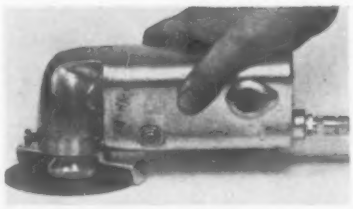
MACHINE & FABRICATING CO., INC.
Depew-Buffalo, New York



Disc grinder

CONVENIENTLY used with one hand, light high-speed disc grinder is built for rugged work. "Nedco Jr." has 10,000 rpm spindle speed, weighs 4½ lb. Versatile tool can be used with small cutting tools or mounted wheels in place of disc.

Housing is strong, light; reduction gears are of steel. Disc diameter is 4 in.; length is 10 in., not including pad. Grinder operates on 110 a-c or d-c, 60 cycle or less. *Nedco Co.*

Circle No. 20.

Atmospheric cleaning

PROCESS for cleaning atmospheric air utilizes industrial filtration equipment. "Ultra-filtration" employs "Wheelabrator" dust collectors of tubular cloth filter type. Filter bags are charged with a filter air which precoats filtering surfaces.

One application is said to last from two to three years under normal conditions. Process may be utilized where disposable or viscous filters or low voltage electrostatic precipitators were employed. *Wheelabrator Corp.*

Circle No. 21.

Electrode

ELECTRODE is for mild-steel welding. A general purpose high-speed, low-slag electrode, the "Steelarc" is applicable with a-c or d-c welders. Low-amperage (40 to 225 amp) deposits exhibit tensile strength of 65-75,000 psi, with yield strength of 58-63,000 psi, and 26-34% elongation in 2 in.

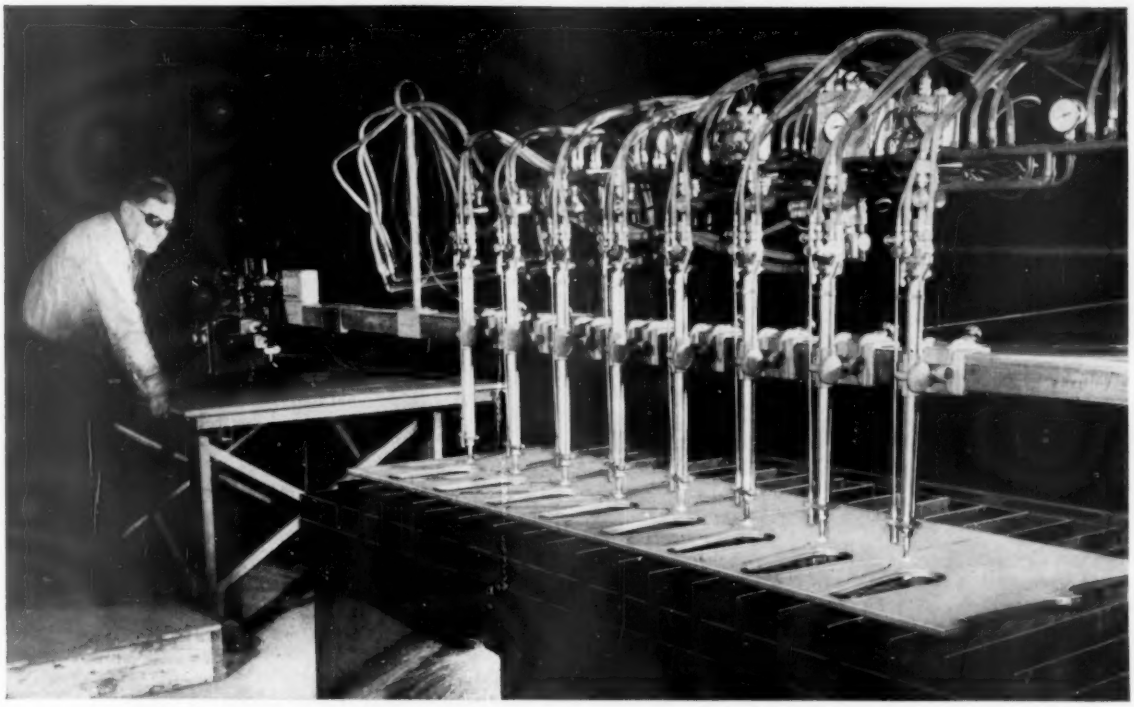
Electrode is recommended for steel fabrication requiring high strength. It is available in $\frac{3}{32}$, $\frac{1}{8}$, $\frac{5}{32}$ and $\frac{3}{16}$ in. core sizes. Sealed tin-plate packages are 10 lb; six packages to carton. *All-State Welding Alloys Co., Inc.*

Circle No. 22.

Weld brush

STAINLESS-steel wire scratch brush is for cleaning stainless weld beads. Brush is claimed to eliminate possibility of oxidation of stainless parent metal caused by using standard steel scratch brushes. *Air Reduction Sales Co.*

Circle No. 23.



Many 'hands' make light work...

...with unerring accuracy

Smoothly, the oxyacetylene torch severs and shapes steel plate with unerring accuracy. This universally accepted method of separating metal—machine gas cutting—has advanced in giant steps since torch cutting was introduced. It is impossible to enumerate the many benefits that modern cutting and welding practices have given the metalworking industry. Inevitably even greater services shall be rendered.

Today's complex production requirements demand machines of extensive range and extreme versatility. Which is the *right* Airco shape cutting machine for you?

- **Airco #50 Travograph.** Track-mounted for unlimited range, this unit shape cuts up to eight identical parts within a full 12′ circle. The cutting torches conform exactly to the movement of an electronic, manual, magnetic, or spindle tracer.
- **Airco #6B Oxygraph.** (Illustrated) This stationary machine shape cuts within a 29′-9½″ x 6′-4½″ area. It operates on the pantograph principle (pioneered by Airco) mounting up to 8 torches.
- **Airco #48 Duograph.** Designed for the smaller metal fabricating shop, the Duograph has a rectangular cutting range of 4′ by any length.

Other Airco machine gas cutting units include the Monograph, Radiagraph, and new Camograph. Details on each are fully covered in individual bulletins. Write today.

WELDING SHOW

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AIR REDUCTION SALES COMPANY

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On the west coast — Air Reduction Pacific Company

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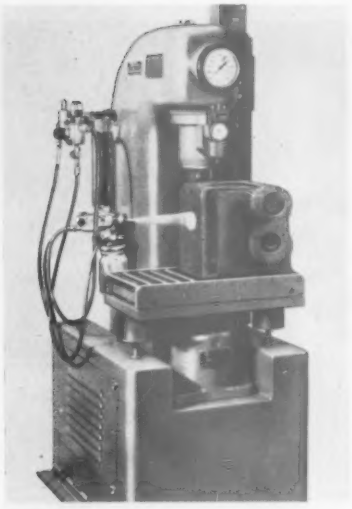
Products of the divisions of Air Reduction Company, Incorporated, include: **AIRCO** — industrial gases, welding and cutting equipment, and acetylenic chemicals • **PURECO** — carbon dioxide, liquid-solid ("DRY-ICE") • **OHIO** — medical gases and hospital equipment • **NATIONAL CARBIDE** — pipeline acetylene and calcium carbide • **COLTON** — polyvinyl acetates, alcohols, and other synthetic resins.



Hardness tester

BRINELL hardness tester is claimed to speed testing. A paint spray attachment is synchronized with testing cycle of the machine. Relative hardness of parts is indicated by spot of paint.

Tester can fit right into roller conveyor. Brinell limits on the machine, designated model "KDRX-6E," are adjustable. Models have either fixed or adjustable openings. *Steel City Testing Machines, Inc.*

Circle No. 24.

Warm-up tube

CONTROLLED warm-up tube "6CG7" is for general purpose use. This 9-pin twin triode tube may also be used as blocking oscillator, phase inverter, multivibrator or any application needing medium twin triode.

Tube has controlled heater warmup characteristic of 11 seconds. Maximum plate voltage rating is 300 volts; plate dissipation is 3.5 watts. *General Electric Co.*

Circle No. 25.

Filler rod

MANAGANESE bronze filler rod, "Ampco-Braz No. 3," is said to have good tinning action when used with ordinary brazing fluxes. It flows easily; melting point is 1,600 F. Deposit has high strength combined with good ductility, claims manufacturer.

Rod is all purpose, general maintenance rod for brazing cast iron, repairing, etc. Conforms to ASTM, Navy and Federal specifications. *Ampco Metal, Inc.*

Circle No. 26.

Electrode

FOR a-c or d-c operation, all-position E6013 electrode, "Fleetweld 37," is claimed easy to use. It is useful in welding sheet metal where burn-through, sticking and poor fit-up may occur or when using low open circuit voltage welders.

"Fleetweld 37" is said to have excellent arc stability. It can be used with smaller transformer-type welders. Arc is soft and smooth. Electrode comes in $\frac{1}{8}$, $\frac{5}{32}$ and $\frac{3}{16}$ in. sizes packed in 50-lb packages. *The Lincoln Electric Co.*

Circle No. 27.

Brazing

NICKEL base brazing alloy, "Nicrobraz No. 10," is for low temperature joining of stainless steels, nickel-base alloys and other metals having melting points above 1,900 F. Also for applications in temperatures from 60 to 1,500 F.

"No. 10" is said to have excellent flow and wetting properties, thin to moderate fillet formation, and no erosion during brazing. Application is with brush. Can be applied with cold or hot spraying. *Wall Colmonoy Corp.*

Circle No. 28.

I Want FASTER PRODUCTION
I Want LOWER COSTS
I Want EASIER HANDLING
ARO
Portable
SPOT WELDERS
* No other machine of its size produces such high welding current
* Easy one-hand operation reduces fatigue . . . enables operator to maintain high production pace
* Easily adjustable spring pressure
* Trip-switch or timer according to model
* Air or water-cooled models
Air-Hydraulic operated gun for high production is also available
ARO Model P-293-A with full 360° movement gyroscopic suspension
ARO SPOT WELDERS
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38-31 CRESCENT STREET LONG ISLAND CITY 1, NEW YORK
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"See Us at Booth 420 ASTE Ind. Exp., Nat'l. Amphitheatre, Chicago, March 19-23"

No "Plumbing" Needed ... NEW AIR-COOLED

HELIARC HW-17 TORCH

Trade-Mark

HANDLES UP TO 150 AMPERES

Shown here in actual size is the only air-cooled torch available for inert gas shielded arc welding with currents up to 150 amperes. With a continuous-duty capacity of 130 amperes (150 amperes for a reduced-duty cycle), this "mighty midget" handles many jobs that formerly required a water-cooled torch. Moreover, the HW-17 is unusually compact and lightweight for easy handling with minimum fatigue.

Elimination of external "plumbing", drain lines, mobile water pumps, and the like cuts original installation costs almost in half and drastically reduces everyday maintenance costs. With the air-cooled HW-17, for example, there are no time-consuming interruptions to clear clogged water passages or to repair leaking water hose connections.

The HW-17 is a tough, shock- and heat-resistant torch fully capable of absorbing the hard knocks of all service within its range. Collets are actuated by a twist of the torch cap to provide easy adjustment of 7- or 3-inch electrodes.

See your local LINDE representative today, or write for further information.

Linde Air Products Company
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GLENN COMPANY
CONSTANT VOLTAGE
News Notes

Is Your Automatic Welding Power Source Outdated?

It is, if you're using variable arc voltage with variable wire feed—and getting variable results!

GLENN Constant Voltage Welders operate at fixed arc voltage, which means fixed wire feed rate for consistently top-quality welding. Results? Better welding, with fewer rejects, at far lower cost!

GLENN CV welders are job-proved for submerged arc, inert gas, CO-2, "squirt" and automatic hard facing and stud welding processes. 4 models—300, 500, 750 and 1200 amp. continuous duty rating, 18-42 v. arc voltage range. Write or wire for literature, application data, prices.

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CONSTANT VOLTAGE PIONEERS
3134 E. 10TH STREET
OAKLAND 1, CALIF.
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CHICAGO 17, ILL.

NEW PRODUCT BRIEFS

Hinged pipe vise has reversible lower jaws, milled on both sides. Self-locking hook is easy to work. *Columbian Vise & Mfg. Co.*
Circle No. 29.

Zinc coating, applicable with brush or spray gun, is for renewing galvanizing on parts and for prevention of corrosion in steel sheets and beams. *Wilbur & Williams Co.*
Circle No. 30.

Light, powerful 6-in. pneumatic cup wheel grinder, "Cleco 2000," can use either straight type or flanged cup abrasive wheel. *Reed Roller Bit Co.*
Circle No. 31.

High speed steel blade for portable electric band saw can cut tough metal materials; useful for cut off in welding shops. *Porter-Cable Machine Co.*
Circle No. 32.

Miniature voltage reference tube, cold-cathode discharge type, is for use in d-c amplifiers, stable regulated power supplies. Range of "5651" is 82-92 volts. *Amperex Electronic Corp.*
Circle No. 33.

Solid carbide end mills, in several varieties, are for rough and finish machining of ferrous, non-ferrous and non-metallic materials. *M. A. Ford Mfg. Co., Inc.*
Circle No. 34.

Saw is a combination hack, jig and coping saw. It is said to fit any ¼ in. electric drill. Can cut metal; good on contour work. *Aladdin Mfg. Co.*
Circle No. 35.

Pre-fabricated sheet metal flexible ball joints, available in eight pipe sizes ranging from 3 to 12 in. in diameter, can be used in installations such as exhaust systems for dust and noxious fumes, and in blower systems for air conditioning and ventilating. *Spincraft Inc.*
Circle No. 36.

Pressure switch "C9612" can sense system pressure over adjustable range of 15 to 3,000 psi. Calibrated plate enables setting before or after installation on pressure line. *Barksdale Valves.*
Circle No. 37.

Transformer "type LS" has capacity range from 100 to 5,000 kva. Unit has built-in oil-level and temperature-indicator gage. *Marcus Transformer Co.*
Circle No. 38.

A A better way to weld heavy steel plates . . .

B Because *Bux* assures perfect alignment and . . .

C Cost reductions in material and LABOR

Here is the tool that SPEEDS the welding and fabricating of heavy steel plates.

The *Bux* portable, magnetic plate clamp delivers perfect alignment with just the flip of a switch. No dogs or wedges. As shown in the illustrations, the *Bux* portable plate clamp is easily moved along the seam to be welded, holding the plates in a powerful magnetic field.

Today is the best time to find out how *Bux* portable magnetic plate clamps can put SAVINGS in your welding and fabricating operations. Your *Bux* dealer can show you how. See him, or write for fully discriptive literature to Buck Mfg. Co., 106 Roberts Road Los Gatos 5, California

DIRECT PULL-OFF PRESSURE . . 3000 lbs.

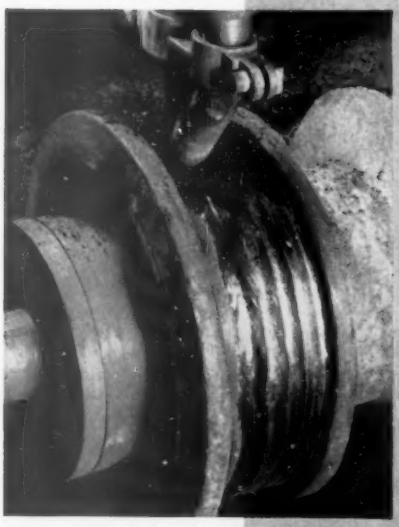
BUX portable magnetic plate clamps

NEW...

Wear O Matic

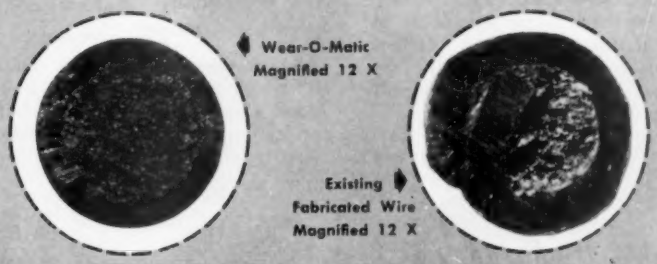
FABRICATED HARD-FACING WIRE

- for easier operation
- for uniform, high-quality welds



COMPARE

this major development in fabricated wire with existing wire . . .



These cross sectional views of fabricated wire were made under identical conditions. Notice the compactness and perfect roundness of Wear-O-Matic precision drawn wire as compared to existing fabricated wire. This dense, controlled diameter wire provides the smooth feeding and excellent arc characteristics of solid welding wire and insures a weld deposit that is uniform in soundness, chemistry and hardness.

Wear-O-Matic OFFERS THESE EXCLUSIVE FEATURES

1. Smooth, trouble-free feed with any automatic head—without special feed rolls or contact tubes.
2. Precision drawn for perfect roundness to insure continuous, smooth feeding.
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4. Electroplated with copper to prevent surface rust and insure positive electrical contact.

Make your own comparison . . .

Write for free sample specimen of new Wear-O-Matic wire—the only fabricated wire that's as easy to use as solid wire. Compare and prove to yourself why Wear-O-Matic is the wire you want now! Just write:

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NEWS . . . . . *from page 6*

discharges an electrically-charged surface.

The surface is on the recording plate which is developed by immersion in an insulatine liquid of fine developer particles. The plate may be cleaned for re-use by wiping or by submerging in a conductive liquid, which will discharge the plate and release particles which make up the image.

Advantages are significant in the field of ordnance where present film and processing costs are high and not always available. With the new method, there is an inexpensive reusable plate and low cost day-light inspection is possible.

Airco to build plant at Calvert City, Ky.

An oxygen plant will be built at Calvert City, Ky., by Air Reduction Sales Co., New York City. The new plant, expected to be completed in spring of this year will also produce nitrogen and argon. It will be the third Air Reduction plant to be built at Calvert City.

The first plant was National Carbide Co.'s acetylene generating and calcium carbide plant. The other is the Air Reduction Chemical Co.'s vinyl acetate monomer plant.

General Welding Co. moves to new plant

General Welding Co., Bethlehem, Pa., manufacturer of fuel tanks, has moved into its new 9,600-sq ft plant on Schoenersville Rd. The company was formerly on Broad St. in that city.

ASTE to meet in Chicago

The 1956 Industrial Exposition, sponsored by the American Society of Tool Engineers, will meet March 19-23 at the International Amphitheatre, Chicago. Conferences and panel discussions of latest advances in production and technology will be a feature.

New hose clamp saves time, money

A new hose clamp which can be connected in three seconds is reported to speed and simplify clamp application on feed lines of welding guns. It is also claimed to provide more effective clamping.

Used with the "Aircospot" welding gun, the one-piece steel clamp has saved Air Reduction Co., New York City, time and expense. Prior to the use of this clamp, known as the "Circle" clamp, the hose lines were fastened by hand wrapping with steel wire. The new clamp is applied simply by squeezing two U-shaped folds, or lugs, with an ordinary pincers. Pressures at the joints range up to 60 psi.

The new clamp is round in shape. In tests it has shown no slippage or loss of clamping action at hose burst pressures ranging from 12,300 to 12,800 psi. Tightness of the clamp fit can be regulated by the distance between the closed lugs. The clamp can be removed by cutting through the wall of one lug with a pincers.

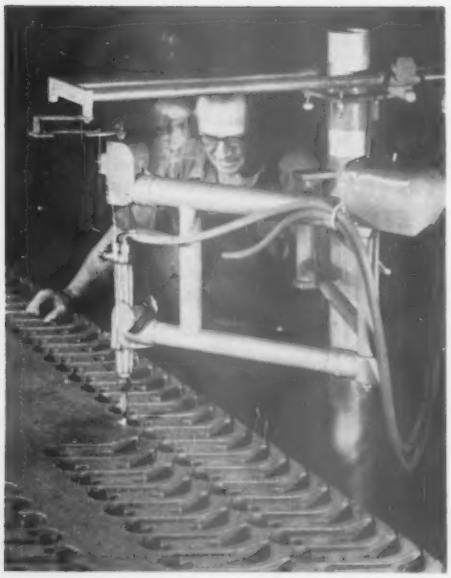
U. S. Steel develops low-nickel stainless

A new grade of stainless steel, containing little or no nickel, has been developed by U. S. Steel Corp., Chicago. A study, conducted by Dr. Dennis J. Carney, has shown that an increase in nitrogen content, and a decrease in nickel content, will produce a stainless steel of good characteristics.

New Heath Ultra-Graph OXYGEN CUTTING

FOR AUTOMATIC, PRECISION METAL CUTTING

5 to 7 times faster than hand torch cutting



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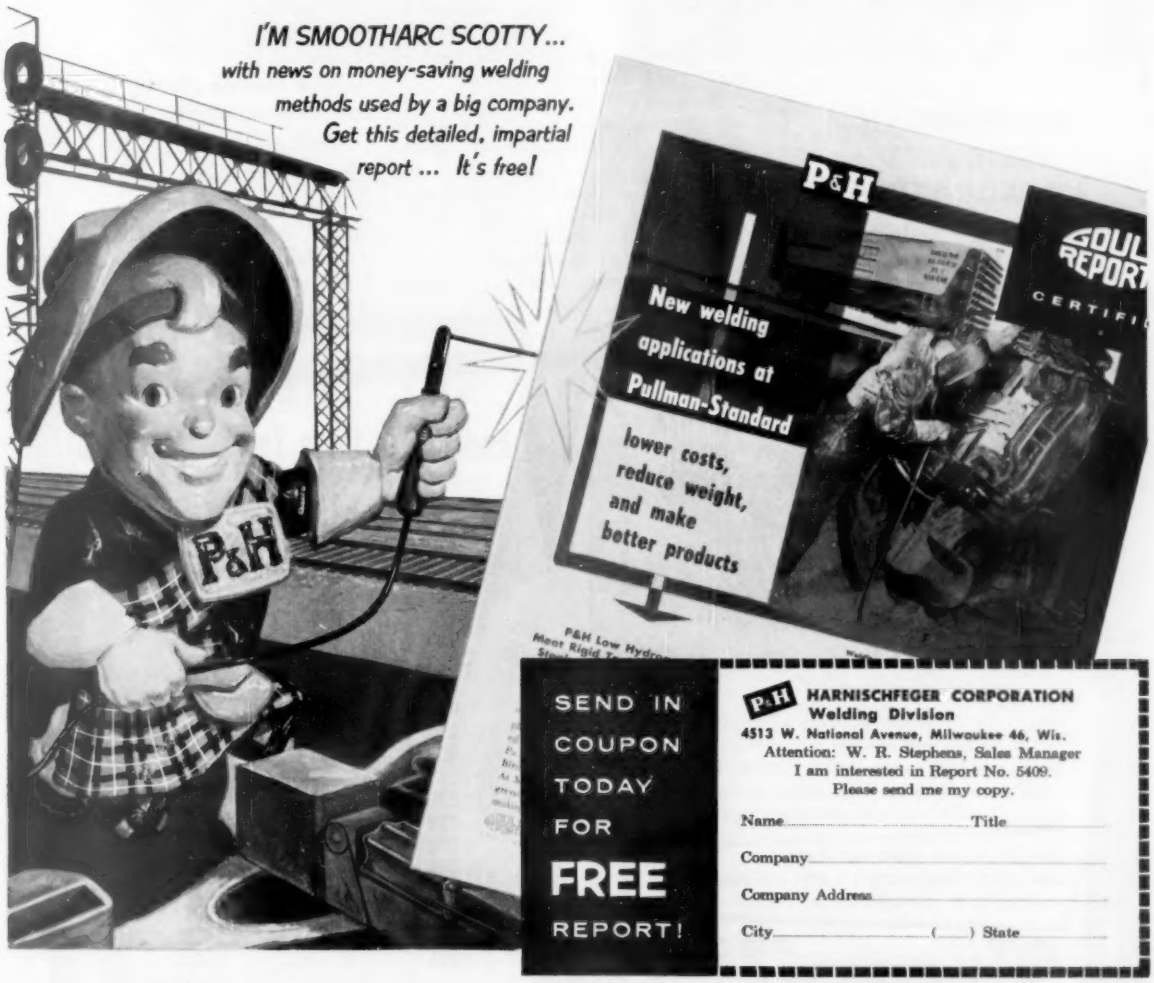
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Pocahontas Welding holds open house

Pocahontas Welding Supply Co., Bluefield, W. Va., held an open house recently to celebrate the opening of its new building. The building, containing 6,000 sq ft of floor space, includes show room, offices and warehouse.

The new location, on the outskirts of Bluefield, provides ample parking space; loading docks in the rear accommodate trucks and trailers. A dock inside provides convenient loading and unloading in bad weather.

—*Hobart Bros. Co.*

Standards engineers meet at Hartford

The fourth annual convention of the Standards Engineers Society was held recently at Hartford, Conn. The 250 attending came from all parts of the United States and Canada.

Sessions included panel discussions on organization of a company standards program; standards for electrical components and equipment; automation; use of standard thicknesses for thin flat metals; and the outlook for establishing standards.

The necessity of standards for efficient production and for quality products was emphasized. Standards, as in the case of NEMA (National Electrical Manufacturers Association) standards operate in the public interest, eliminating misunderstanding between manufacturer and purchaser.

Iowa distributor celebrates anniversary

The Kacena Co., Cedar Rapids, Ia., welding distributor, celebrates its 30th anniversary as a distributor with a Welderama and industrial exhibit at its new store and general office, March 7 and 8 in that city.

A feature of the Welderama will be demonstrations of the most advanced methods of welding, cutting and other metal fabricating processes. There will be motion pictures of new products and processes and displays of latest equipment.

Atomic electric plant has welded fittings

Welding pipe fittings of the nuclear reactor which supplied the first commercial electricity, via lines of the Niagara Mohawk Power Co., West Milton, N. Y., were fabricated by Tube Turns, division of the National Cylinder Gas Co., Louisville, Ky.

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125	388	1050
138	400	1100
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163	425	1200
175	438	1250
188	450	1300
200	463	1350
213	475	1400
225	488	1450
238	500	1500
250	550	1550
263	600	1600
275	650	1650
288	700	1700
300	750	1750
313	800	1800
325	850	1850
338	900	1900
350	950	1950
363		2000

1. **High climb to tack weld top course of a sulfate digester in position. Chicago Bridge & Iron Company makes the parts shown of 10% Inconel-clad steel under the trade name HORTONCLAD®. Its Inconel (a nickel-chromium alloy) surface withstands corrosion by pulping liquor at 340-360°F. and under 125 psi pressure. The welds do, too. That's because . . .**

2. **Inconel-clad side is welded first with "142" 80/20 Nickel-Chromium Electrodes. This minimizes iron dilution in the welds. The resulting weld metal matches the Inconel cladding in corrosion resistance. So — for lower costs — after the first bead the weldor switches to "132" Inconel Electrodes. This electrode is produced for welding Inconel to itself, but can be used in this application since the "142" deposit provides proper control of iron dilution. So . . .**

Look At This Big Pulp Digester To See How...

Inco "142" and "132" Electrodes Simplify Welding Inconel-Clad Vessels

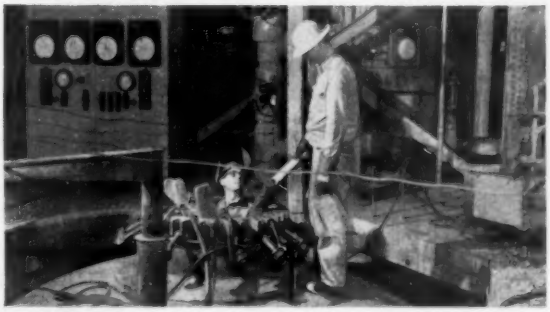
When *you* weld Inconel-Clad Steel, use "142" 80/20 Nickel-Chromium Electrodes for the first pass on the clad side to reduce iron dilution.

And, *then,* use "132" Inconel Electrodes for the balance of the beads to get welds with all the high temperature strength and corrosion resistance of Inconel*—*at lowest cost.*

Assistance, if you need it, comes in two ways. First, from Inco's Technical Service Section. They'll gladly answer questions about welding the Inco Nickel Alloys. Second, from Technical Bulletin T-2, *Fusion Welding of Nickel and High Nickel Alloys.* Write for a copy today.

*Registered Trademark ®Chicago Bridges & Iron Company

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York 5, N. Y.



3. **When the top's on, the entire job passes ASME requirements for pressure vessels. Two tensile tests, four side bend tests, and about twenty spot radiograph tests per vessel! The digester you've seen and another installed at the same time took 250 man-hours of welding, 400 lbs. of "142" 80/20 Nickel-Chromium Electrodes, and 200 lbs. of "132" Inconel Electrodes.**

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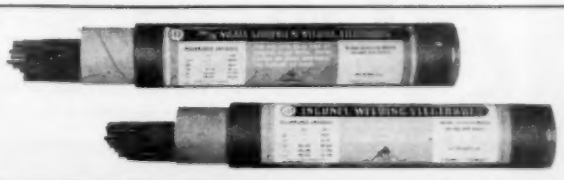

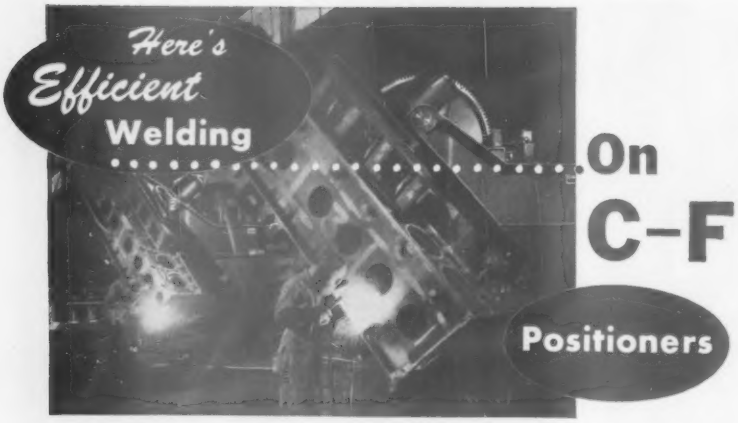

When heavy, unwieldly weldments like these diesel crankcases can be quickly swung into any position so that every weld is made *downhand* —that's efficient welding!

Welders spend more time welding—do better welding at lower cost when they work with C-F Positioners because these hand and/or power operated machines reduce positioning time to a minimum. Investigate the cost-saving advantages of C-F Positioners. They pay their way in any company.

Write for Bulletin WP26—an illustrated circular detailing the *Specific* advantages of C-F Positioners.

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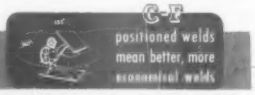

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105 **Medium Temperature Solder** Good for 18,000 psi Shear. This low cost silver solder requires no more than 750 F. for joining wide range of ferrous and non-ferrous metals.

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ALL-STATE WELDING ALLOYS CO., INC., WHITE PLAINS, N. Y.

Grinding Wheel Institute elects new president

Grant S. Diamond, president of Electro Refractories & Abrasives Corp., Buffalo, N. Y., has been elected president of the Grinding Wheel Institute. Headquarters of the institute are in Cleveland.

CGA meeting approves changes

At the recent December meeting of the executive board of the Compressed Gas Association, Inc., several recommendations were made for improved operation. The board named Edwin A. Olsen technical secretary to supervise technical activity.

It was recommended that serious effort be given to promotion of membership during this year.

Also, the following individuals will serve as a nominating committee to recommend candidates for the executive board, and as officers of the association for 1956: G. C. Cusack, chairman; H. Bartholomew, H. T. Hancock, D. M. Horner, C. E. Monlux, R. B. Swope, W. P. Uhler.

New members join NWSA

National Welding Supply Association, Philadelphia, has received applications for membership from the following: Action Welding Supply Co., Baton Rouge; Central Welding Supply, Houston; Daigle Welding Supply, Inc., Opelousas, La.; Gulf Welding Supply, Harlingen, Texas; Red Ball Battery & Supply Co., Inc., Shreveport, La.; The Welders' Supply Co., Baltimore, Md.; Doussan Tool & Supply Co., New Orleans; Travis Welding Supply, Inc., Dallas.

New oxygen specification issued by government

Final version of "Federal Specification BB-O-925, Oxygen, 99.5 Percent, Gas and Liquid" has been issued for use by all government agencies in procuring oxygen. The specification, as issued, does not include all recommendations of the International Acetylene Association. It does, however, eliminate performance of elaborate, non-plant type U. S. Pharmacopoeia tests.

Conformance to all USP requirements is called for, with the exception of one grade of gaseous oxygen. This is termed "Technical Oxygen" in the specification. Required tests are those for oxygen purity, moisture, odor, and correctness of cylinder filling pressure.

Toronto CWS honors welding pioneer

A pioneer of the coated electrode, George J. Foster, was honored at the recent December meeting of the Toronto, Ont., chapter, Canadian Welding Society. Mr. Foster received a lifetime membership to the chapter and was presented with a silver tray by Robert Scott, CWS president. Mr. Foster has been chapter secretary for the past 10 years.

During the first world war, Mr. Foster served in France with various technical sections. After the war he promoted use of the first coated electrode. In 1926 he was sent to the United States to continue his work with the coated electrode and also extend use of the a-c welding machine. During the second world war, Mr. Foster went to England to join the Ministry of Supply. He joined the Canadian Welding Bureau and CWS after the war.

Electric welding discussed by AIEE

Problems met in electrical welding were to have been reviewed at the five-day winter general meeting of the American Institute of Electrical Engineers, Hotel Statler, New York City, Jan. 30-Feb. 3. Chairman of the welding conference was J. F. Deffenbaugh, chief electrical engineer, Federal Machine & Welding Co., Warren, Ohio.

Topics to be discussed were influence of atmospheric water vapor on high current d-c areas, cathode instability in argon atmosphere, let-go currents and voltages, inert gas-shielded welding arc behavior and metal transfer characteristics.

COMING EVENTS

FEB. 1-2: Second Annual Midwest Welding Conference, Armour Research Foundation of Illinois Institute of Technology, Chicago.

FEB. 22-24: Welding Applications Institute, University of Wisconsin, Madison.

MARCH 12-14: Fifty-sixth Annual Convention, International Acetylene Association, Hotel Statler, Los Angeles.

MARCH 19-22: Twelfth Annual Convention, National Welding Supply Association, Hotel Roosevelt, New Orleans.

MAY 8-11: Thirty-seventh Annual Meeting, American Welding Society, Hotel Statler, Buffalo.

MAY 9-11: Fourth Annual Welding Show, Memorial Auditorium, Buffalo.

OCT. 8-12: National Fall Technical Meeting, American Welding Society, Cleveland.

OCT. 8-12: Thirty-eighth National Metal Exposition and Congress, Cleveland Public Auditorium, Cleveland

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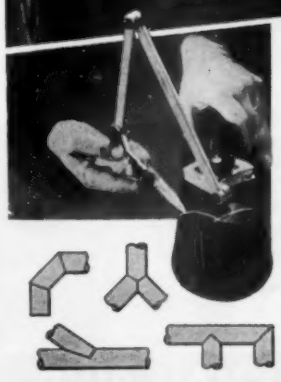

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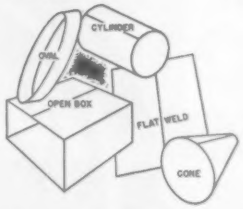

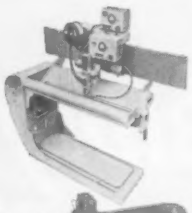

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High Roller Face Pressure. Cold works welds and adjacent areas, flattens and smooths fushion welds, increases mechanical properties, reduces grinding. Also flattens flash welds, mash welds, resistance welds and elongated weld areas. Diameters 1¾ in. to 10 ft., and to 10 ft. lengths on large diameters.

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Harris Calorific Sales Co. incorporates

Harris Calorific Sales Co. of New York, Cranford, N. J., was incorporated Jan. 3, with the following officers: W. R. Flannery, chairman of the board; J. W. K. Fromm, president; M. J. O'Leary, secretary-treasurer.

The Promise of 1956

The year ahead—what does it hold? A year-end report of the U. S. Department of Commerce predicts industry will continue in a favorable condition, with some expansion. This will include copper, in short supply during 1955.

Outlook: favorable

The industry survey indicates business will operate close to peak level through the first six months of this year. It gives these estimates for the first half:

The high steel production of the last half of 1955 will carry into this year, making the first half a record-breaker. Addition of new facilities is planned. Tight steel supply will affect some steel products, especially plates, sheets, strips, structurals and certain tubular products.

Aluminum shipments are expected to be at an annual rate of 4,600,000,000 lb, a new high. Total 1955 aluminum shipments are put at 4,100,000,000 lb, 36% above 1954.

Copper supply will continue short, to approach demand in the second quarter when new production will add to domestic supply.

The survey predicts high automobile output with trucks to continue strong. The aircraft industry has a $13,500,000,000 order backlog. Present and future shipbuilding orders are 18% higher that a year ago. However, the current total is only 25 to 30% of normal good volume.

New railroad freight cars are not expected to increase due to shortage of steel shapes and forms.

New construction expenditure is put at $44,000,000,000 which is 5% above the $42,000,000,000 record of last year.

Machine tool shipments may reach $430,000,000. This compares with $409,000,000 in the same period for last year. Shipments for 1955 are estimated at $800,000,000.

Power equipment will have a setback due to the strike at Westinghouse Electric Corp.'s plants, cutting generator and turbine output. Farm machinery, predicts the survey, will not increase unit production.

Rensselaer Polytech studies welding high-temp alloys

An examination of high temperature alloy reactions to welding processes has begun at Rensselaer Polytechnic Institute, Troy, N. Y. Dr. Ernest F. Nippes, director of welding research, is in charge of the program commissioned by Westinghouse Electric Corp., Pittsburgh.

Earlbeck & Landrum hold welding clinic

An educational welding clinic recently sponsored by Earlbeck & Landrum, Inc., Baltimore, Md., and The Lincoln Electric Co., Cleveland, proved a success. Subject of the clinic, held during November and December, was "Practical welding metallurgy." Instructor was George E. Linnert, senior research engineer for Armco Steel, Baltimore.

Six evening lectures were held at the offices of Lincoln in Baltimore. These were attended by representatives of local industries. The seventh meeting was held at showrooms of Earlbeck & Landrum. It consisted of practical demonstrations and was attended by 125 persons. The latest in equipment and techniques were shown.

An excellent example of close cooperation between a manufacturer and distributor, the clinic accomplished a twofold purpose: it actively promoted greater use of welding; it provided Baltimore users of welding with new and authoritative information of advancements in welding engineering.

Distributor appointments

Adamas Carbide Corp., Kenilworth, N. J.: Todd Machinery Co., Salt Lake City.

All-State Welding Alloys Co. Inc., White Plains, N. Y.: Superior Oxygen Co., Ukiah, Calif., D&R Welding Supply Co., Decatur, Ill: Thompson Bros. Welding Supply, Coffeyville, Kans.; Hay's Supply Co., Paducah, Ky.; Peerless Supply Co., Shreveport, La.; Wilson Welding Supply Co., Cumberland, Md.; Miller Bros. Iron & Metal Co., Inc., Manistee, Mich.; Woods Welding Supply Co., Windom, Minn.; Eastern Distributors, Patchogue, N. Y., Welders Service & Supply Co., Cincinnati; C. F. Myrow Supply, Houston; Pocohontas Welding Supply, Bluefield, W. Va.

Ampco Metal, Inc., Milwaukee: Miami Welding Supply, Inc., Miami; Kaminis Welding Supplies, Inc., Tampa; Keenan Welding Supplies Co., Inc., Albany, Ga.

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- Welding horns can be moved in and out, rotated 360°
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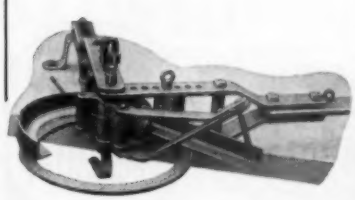

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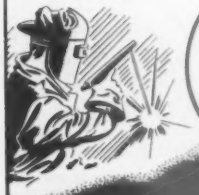

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Rex L. Nicholson, west coast industrialist, was elected president and chief executive officer of The Liquid Carbonic Corp., Chicago, at a recent meeting of the board of directors. Mr. Nicholson in recent years has been president of Pacific Tractor & Implement Co., Richmond, Calif. He has also been prominent in public service, frequently acting in a supervisory capacity to various governmental agencies. In 1951 he organized the Federal Civil Defense Administration. *P. F. Lavedan* was also re-elected chairman of the board at the same meeting.

Titan Metal Mfg. Co., Bellefonte, Pa., has announced the following promotions: *Grey W. Tressler* has been named vice-president, manufacturing. Formerly works manager *W. E. Dunnick* will succeed him. *Marvin J. Rothrock* has been named vice-president and director of purchases; *Ralph H. Lightner* has been named vice-president and sales manager. *H. Chapman Ward* has been named vice-president and cost controller.

Tressler

Clarence M. Taylor has been elected president of Harris Calorific Co., Cleveland, succeeding the late Lorn Campbell, Jr. Mr. Taylor has been associated with The Lincoln Electric Co., Cleveland, most recently as a director, which association he continues. He joined Lincoln Electric in 1916 as a shop apprentice and was elected executive vice-president in 1946. He is a member of the American Welding Society, Cleveland Chamber of Commerce and a director in a number of firms. *John R. Milligan* was appointed vice-president. He will direct all administrative functions of Harris Calorific. He has been with Harris Calorific for 20 years and was secretary-treasurer, previously.

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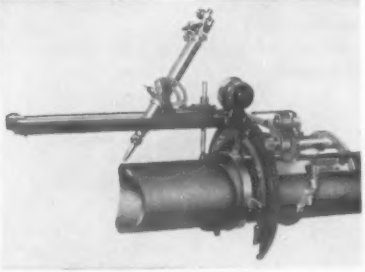

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Suydam

Haile

E. B. Suydam has been appointed president of Linde Air Products Co., a division of Union Carbide & Carbon Corp., New York City. He succeeds *T. D. Cartledge* who continues as a vice-president of the corporation. Mr. Suydam joined the Union Carbide organization in 1916 as a salesman. He became vice-president of Linde in 1942. *William M. Haile* has been appointed a vice-president. He has been with the firm since 1925, becoming manager of the eastern division in 1952.

J. Carlisle MacDonald, assistant to chairman of the board, in charge of public relations, U. S. Steel Corp., Pittsburgh, has retired. He organized U. S. Steel's public relations department in 1936 and has been in charge since that time. *Phelps H. Adams* has been appointed executive director-public relations, and assistant to chairman of the board; *Charles W. Huse* has been named director-public relations administration.

Metal & Thermit Corp., New York City, has announced the following appointments: *Charles H. Carpenter, Jr.*, has been named assistant manager, market development department, to be located in New York City; *Henry Bryk* has been named superintendent of the thermit metal department, with offices at the company's Carteret, N. J. plant; *C. J. Beasley*, formerly controller and assistant secretary, has been named a vice-president, to direct financial activities; *C. R. Hervey* has been appointed controller.

Bryk

Karl H. Schmuldt has been elected vice-president, sales, by the board of directors of K-G Equipment Co., a division of Air Products, Inc., Allentown, Pa. Mr. Schmuldt, formerly sales manager of K-G, will headquarter at Allentown.

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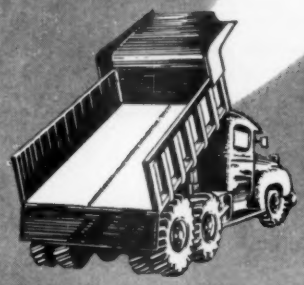

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Clark B. Frothingham has been appointed district sales manager for northern Illinois territory by Adamas Carbide Corp., Kenilworth, N. J.

J. W. Kenefic, superintendent railroad service, western region (Chicago office) for Air Reduction Sales Co.'s railroad department, has retired after 36 years with the company. *R. L. Rex*, superintendent railroad service, eastern region, has been named to succeed Mr. Kenefic. Mr. Rex will remain at Air Reduction Co.'s home offices in New York City.

Died . . .

Dr. Horace H. Lester died recently after a short illness. He was 71. Dr. Lester was a pioneer in the field of industrial radiography. Until his retirement in 1954, he had been principal physicist at Watertown Arsenal Laboratories, Watertown, Mass. He developed radiography for quality control of castings and a method for X-ray inspection of welds. He organized, and was chairman for 10 years, of Committee E-7 (Radiographic Testing) of the American Society for Testing Materials. Dr. Lester received the Especially Meritorious Civil Service Award from the War Department in 1943 for his work in radiography.

J. P. H. Wasserman died Nov. 21 at the age of 82 in Basel, Switzerland. He was the father of Rene D. Wasserman, founder and president of Eutectic Welding Alloys Corp., Flushing, N. Y. In 1906, the elder Mr. Wasserman observed the phenomenon of surface alloying in brazing for the first time. He adapted it into his process of non-fusion welding later perfected by his son. The Societe des Soudres Castolin, which Mr. Wasserman established in Lausanne, Switzerland, produces welding alloys with international distribution. Surviving are his widow, Emmeline, and his son.

Mandel Lowenstine, 73, president of Central Steel & Wire Co., Chicago, died Jan. 3. He was co-founder of of the firm in 1909. Central Steel was a pioneer in manufacture of welding electrodes and rods. Mr. Lowenstine is survived by his wife, Daise; a son, James R.; two sisters and a brother.

30 YEARS AGO

J. N. Walker was recently appointed general sales manager of Oxweld Acetylene Co., New York City. L. D. Burnett was named eastern department sales manager, succeeding Mr. Walker. Z. T. Davis, Jr. has been appointed assistant sales manager of the eastern department.

—30 YEARS AGO—

W. Girdler, Kentucky Oxygen-Hydrogen Co., A. J. Russell, Bettendorf Oxygen-Hydrogen Co., and O. E. Engler, Balbach Co., were in Chicago this month for a meeting of the executive committee of the Gas Products Association.

—30 YEARS AGO—

H. J. Barnes was elected vice-president of Alumino-Thermic Corp., Roselle Park, N. J., at a recent board of directors' meeting.

—30 YEARS AGO—

General Electric Co., West Lynn, Mass., has announced plans for construction of a one-story oxygen and hydrogen plant.

—30 YEARS AGO—

C. J. Haines of Keith Dunham Co., Chicago, left the United States early *this month for a trip to Europe.*

—30 YEARS AGO—

The first chapter of the Master Welders Association has been formed in Oakland, Calif., by R. O. Waldman, representative of Chicago Steel & Wire Co.

—30 YEARS AGO—

A feature article discusses the adoption of electric welding for fastening structural pieces by McClintic-Marshall Co. of California, Los Angeles. The firm is said to be one of the largest structural steel fabricating plants in southern California. Welding, it is felt, will eliminate rivets and reduce costs.

—30 YEARS AGO—

An interesting item is the use of oxyacetylene torch in repairing props for Hollywood movies. A photograph shows Miss Helen Foster watching a weldor at work on a Ford Car. It will be used for an auto-polo game in the film "Lickety Split."

—30 YEARS AGO—

Delegates of 77 firms attended a welding conference at Purdue University, Lafayette, Ind.

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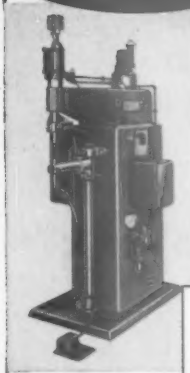

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ADVERTISERS IN THIS ISSUE

Adjustable Clamp Co. 86
Airline Welding & Engineering 80
Air Reduction Sales Co. 58, 69
Allen Co., L. B. 86
Allied Steel & Tractor Prods., Inc. 86
Alloy Rods Company 59
All-State Welding Alloys Co., Inc. 78
American Brass Co. 47
American Chain & Cable Co., Page Steel & Wire Div. 50-51
American Manganese Steel Div., American Brakeshoe Co. 54
American Optical Company 33
Ampco Metal, Inc. 10
Amperex Electronic Corp. 41
Arcair Company 44
Arcos Corporation 60-61
Aro Spot Welders, Inc., Div. of Guthery Machine Co. 70
Atlas Welding Accessories Co. 9

Becker Bros. Carbon Co. 84
Buck Manufacturing Co. 72

Cayuga Machine & Fabricating Co. 68
Columbia Electric Mfg. Co. 84
Contour Marker Corp. 79
Cullen-Friestedt Co. 78

Dalweld Company 83
Drawalloy Corp. 73

Eastman Kodak Co. 45
Eisler Engineering Co., Inc. 86
Erico Products, Inc. 2

Fibre-Metal Products Co. ..... Inside Front Cover

General Electric Co. 14, 15, 16
General Electric Co., Electronic Tube Division 56-57
Glenn Company 72
Guthery Machine Co., Aro Spot Welders, Inc., Div. 70

H & M Pipe Beveling Machine Co. 82
Harnischfeger Corp. 75
Harrisburg Steel Corp. 85
Harris Calorific Co. 67
Heath Engineering Co. 74
Helmco, Inc. 42
Hobart Bros. Co. 1
Hossfeld Mfg. Co. 81

International Nickel Co., Inc. 8, 77
Invincible Vacuum Cleaner Mfg. Co. 46

Jackson Products ..... Front Cover

Kasson Die & Motor Corp. 81

Linde Air Products Co., A Div. of Union Carbide & Carbon Corp. 71
Lincoln Electric Co., The 18
Liquid Carbonic Corp. 64

Mallory & Co., Inc., P. R. 13
Metal Bond Mfg. Company 86
Metal & Thermit Corp. 53
Miller Electric Mfg. Co. 65

National Carbide Co. 79
National Welding Equipment Co. 7
North American Philips Co., Inc. 48
Norton Company 11

Page Steel & Wire Div., American Chain & Cable Co. 50-51
Progressive Welder Sales Co. 39

Reid-Avery Co. 43

Shawinigan Products Corp. 76
Shieldalloy Corp. 82
Smith, A. O. ..... 62-63, Back Cover
Smith Welding Equipment Corp. 12
Steel Sales Corp. 85
Stoody Company 35
Stultz-Sickles Co. 83

Tec Torch Co., Inc. 84
Tempil Corporation 76
Tweco Products Co. ..... Inside Back Cover

Union Carbide & Carbon Corp., Linde Air Products Co. 71
United Wire & Supply Co. 65

Vickers Electric Div., Vickers, Inc. 37
Victor Equipment Co. 4, 20

Wagner Mfg. Co. 17
Weldit, Inc. 80

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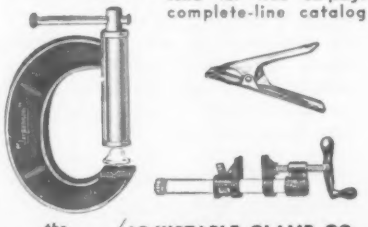

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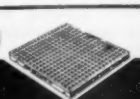
Welding  **Platens**
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51. BRAZING HEATER—Helmco, Inc. Folder describes "Helmco-Lacy" flux pot, a new unit designed for warming and controlling constant temperature of brazing and soldering flux.

52. WELDING PLATEN—Acorn Iron & Supply Co. Brochure discusses semi-steel bending blocks for use as a welding platens in layout work, welding and assembling. Standard and special stands and tools and accessories are described.

53. POSITIONERS—Unique Turn Table & Equipment Corp. 4-page catalog No. 54 lists with brief descriptions, models of positioners, turning rolls, and attachments.

54. FLAME-CUTTING—Smith Welding Equipment Corp. Folder (Form No. 239) contains helpful cutting hints and specifications on oxyacetylene cutting tips.

55. TIP CLEANERS—Maitlen & Benson, Inc. Handy booklet describes construction and uses of "Wypo" tip and orifice cleaners.

56. ELECTRODE—Aufhauser Bros. Corp. Sheet gives applications and procedure for welding with No. 806 "Cut-Rod" cutting electrode for rapid cutting, piercing, gouging.

57. RADIOGRAPHY—Holger Andreasen, Inc. Illustrated leaflet details X-ray inspection with "Andrex" portable industrial units.

58. TUBE, PIPE NOTCHER—Vogel Tool & Die Corp. 4-page folder illustrates and describes "Arc-Fit" tube and pipe notching tool.

59. WELDING HELMET — Fibre-Metal Products Co. 16-page pocket-size booklet discusses, with illustrations, welding helmets, electrode holders, headrest goggles, rod carriers, hammers.

60. TRANSFORMERS—Langevin Mfg. Corp. Brochure relates types of transformers, amplifiers, reactors, and other types of electronic equipment.

61. WELDING DATA—Ampco Metal, Inc. The fourth quarter issue of *Ampco Welding News* has feature article on welding repair of large crankshaft twisting machine.

62. INDUSTRIAL APPAREL—Worklon, Inc. 16-page catalog describes acid- and caustic-resistant industrial apparel.

63. ELECTRODE—Alloy Rods Co. Data sheet illustrates and describes iron powder low hydrogen electrode "Type 8016N", an all-position electrode for nickel steel.

64. GROUND CLAMP—Standard Portable Cord Mfg. Co., Inc. Catalog sheet describes and illustrates "Magic" welding ground, a magnetic ground clamp, especially useful on tanks, pipes, large ferrous sheets.

65. WELDERS—Thomson Electric Welder Co. Bulletin 319 describes "F-2" series of flash and butt welders for resistance welding.

66. AUTOMATIC WELDERS — Cayuga Machine & Fabricating Co., Inc. Bulletin No. 5301 is 4-page discussion of automatic welding equipment available, including turning rolls, horn jigs, positioners.

67. WELDING CONTROL—Robotron Corp. Bulletin 60ROIE-A presents, in detail, up-down slope control electronic unit for resistance welders.

68. BRAZING—Wall Colmonoy Corp. Two-color 3-page data sheet No. 12 describes "Nicrobraz" stainless brazing alloy in paste form, giving composition, properties and applications.

69. BRONZE WELDING ROD—Titan Metal Mfg. Co. Folder presents, in illustrated form, the types, compositions and uses of bronze welding alloys.

70. RADIOGRAPHY—Ind-X Corp. Pictorial pamphlet discusses X-ray inspection with "Ind-X" portable radiographic inspection unit.

71. ABRASIVE—Wheelabrator Corp. 8-page bulletin 89-B describes "Wheelabrator Steel shot," a cast steel, heat treated blast cleaning and peening abrasive.

72. WELDING FITTINGS—The Babcock & Wilcox Co. 6-page folder FB-500 furnishes in concise form the types of welding fittings and flanges.

73. CARBIDE SELECTOR—Adamas Carbide Corp. Handy pocket-size guide, "Adamas Carb-A-Grade Selector," features tables of cutting grades and other helps for selection of proper carbide grade.

74. METAL CLEANING—Acoustica Associates, Inc. Bulletin DR-400 describes ultrasonic cleaning equipment for production cleaning, degreasing.

75. WELDERS—The Lincoln Electric Co. Bulletin 1343 discusses advantages of "Idealarc" a-c/d-c welder. Feature is arc selection for particular type of job.

76. CARBON DIOXIDE—Pure Carbonic Co. 4-page leaflet describes CO_2 supply systems available for welding.

77. WELDOR'S TOOLS—Master Pneumatic Tool Co., Inc. Bulletin 1020 catalogs models of drills, nut setters, screw drivers (all air-powered) with specifications.

78. FLAME-CUTTING — Air Reduction Sales Co. 20-page illustrated catalog (Form ADC 707) describes operation and construction of No. 50 "Travograph" oxyacetylene multiple-torch shape-cutting machine.

79. ELECTRODE—Mir-O-Col Alloy Co., Inc. Brochure treats "No. 2" hardfacing electrode for rebuilding heavy-duty equipment.

80. FLEXIBLE HOSE—Flexaust Co. Bulletin 60 gives latest information on flexible hose for dust, fume control.

81. GENERATOR—General Electric Co. Bulletin GEA-6400 outlines, in 12 pages, construction and uses of mobile-power generator in welding.

82. FLUXLESS SOLDERING—Aeroprojects, Inc. 16-page bulletin SB-5 explains "Sonobond" method of ultrasonic fluxless soldering, requiring no corrosive flux.

83. CLAMPING ASSEMBLIES — Jergens Tool Specialty Co. Descriptive folder illustrates 12 strap clamp assemblies in number of sizes.

84. PLASTIC PIPING—Alpha Plastics Inc. Two folders, with charts, tell applications, sizes, properties and fittings of "PVC" corrosion-resistant pipe.

85. AUTOMATIC WELDING—Glenn Co. Four catalog sheets list models and prices of automatic welders.

86. BRAZING—Handy & Harman. No. 70 of *Low Temperature Brazing News* contains case histories of brazing using "Easy-Flo" brazing alloy.

87. COVER LENSES—American Industrial Safety Equipment Co. Descriptive sheet and pocket-size folder treat "Enduron" cover plates and lenses.

88. HARDFACING—Coast Metals, Inc. Booklet "Hard surfacing alloys" discusses new line of hardfacing alloys available in either coils for automatic welding or cut to length for manual use.

89. AIR FILTER—Hankison Corp. 4-page bulletin M-7155 includes a moisture-vapor content chart for evaluation of water vapor in a compressed air system. Also discusses equipment for dehydration and filtration.

90. CONNECTORS, TERMINALS—American Pamcor Inc. Illustrated 25-page catalog details commonly used terminals, connectors, splices and installation tools.

91. PIPING SUPPORTS—Bergen Pipesupport Corp. 56-page illustrated catalog No. 551 describes variety of pipe hangers and supports designed for power, process industries, refineries, marine work.

92. ELECTRODES—Alloy Rods Co. "Electrode selector guide" contains hints and aids for proper selection of "Arcaloy" stainless steel electrodes.

93. GRINDING—Engelberg Huller Co. "How Abrasive-Belt Grinding Increases Production" is a 31-page booklet consisting of 46 illustrated case histories, grouped according to five types of abrasive belt machining.

94. METALWORKING—J.F. Kidder Mfg. Co., Inc. Illustrated circular describes "Little Blacksmith" No. 55 metalworking machine.

95. TIG WELDING—Linde Air Products Co. Booklet (F-7980) treats the process of Tig (tungsten inert-gas) welding with a "HWM-1" semi-automatic welder.

96. GRINDING WHEEL—Bay State Abrasive Products Co. Catalog sheet (Form DR-2) gives description and applications of "BF" reinforced grinding wheel for portable grinding and cut-off on weldments.

97. WELDER—Graham Mfg. Corp. Illustrated sheet describes "Model 300" single-gun bench welder for automatic welding.

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151. A. O. Smith Corp.—Details on "SW-44" iron-powder electrode and catalog containing information on electrode classifications.

152. Smith Welding Equip. Corp.—Information on regulators.

153. Stoody Co.—Guidebook gives full particulars on alloy recommendations and hardfacing procedures.

154. Stulz-Sickles Co.—Detailed specifications on manganese-nickel steel hot-rolled plates.

155. Tempil Corp.—Information on, and sample pellets of, temperature indicators.

156. Tweco Products Co.—Catalog on complete line of arc-welding accessories and aluminum arc-welding cable.

157. Vickers Electric Div.—Bulletin on d-c magnetic-amplifier welder.

158. Victor Equipment Co.—Manual and descriptive leaflets on coated high-alloy and other welding rods.

159. Wagner Mfg. Co., Inc.—Descriptive literature on "Hi-Amp" electrode holders.

160. Weldit, Inc.—Complete information on "Duo-trol" regulator for light and heavy-duty welding.

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102. Airline Welding & Engr.—Data and samples on fusion butt welds.

103. Air Reduction Sales Co.—Catalog 9-13WE on rods and fluxes for joining both ferrous and non-ferrous metals and bulletins giving details on various gas-cutting machines.

104. Alloy Rods Co.—Bulletin on nickel-manganese electrodes.

105. All-State Welding Alloys Co., Inc.—Pocket reference on joining aluminum and aluminum alloys.

106. American Brass Co.—Information about "Anaconda" welding rods.

107. American Manganese Steel Div.—Catalog giving analyses, metallurgical information, other data on hardfacing alloys.

108. Amperex Electronic Corp.—Data sheets and name of distributor nearest you on regular and temperature controlled plastic coated ignitrons.

109. Arcair Co.—Details on process of metal removal on stainless steel by torch and case-history book on advantages of arc-cutting and gouging torch.

110. Aro Spot Welders—Literature on portable spot welders.

111. Becker Bros. Carbon Co.—Information on carbon welder brushes for all types and makes of welding equipment.

112. Buck Mfg. Co.—Descriptive literature on portable, magnetic plate clamps.

113. Cayuga Machine & Fabricating Co., Inc.—Information on automatic welding equipment.

114. Columbia Electric Mfg. Co.—Catalog WE-400 on "Tong Test" ammeter.

115. Contour Marker Corp.—Information and instruction book on laying out pipe joints.

116. Cullen-Friestedt Co.—Bulletin WP26 detailing the specific advantages of "C-F" positioners.

117. Dalweld Co.—Samples of nickel-silver and low fuming bronze.

118. Drawalloy Corp.—Samples of precision drawn wire for automatic and semi-automatic hardfacing.

119. Eisler Engineering Co., Inc.—Data on spot welders and general welding equipment.

120. Erico Products, Inc.—Catalog on electrode holders and information on "Caddy" test installation program.

121. General Electric Co.—Bulletin GEA-6243 on a-c welders and electrode catalog GED-2584.

122. General Electric Co.—Bulletin GEA-6242 on rectifier welders.

123. General Electric Co.—Bulletin GEC-644 on m-g welders and Bulletin GEC-1333 on 200-amp engine-drive welder.

124. Glenn Co.—Literature, application data, prices on constant voltage welders.

125. H & M Pipe Beveling Machine Co.—Folder, "More Profit Dollars In Pipe Fabrication."

126. Harnischfeger Corp.—Report 5409 on "P & H" low-hydrogen electrodes.

127. Harrisburg Steel Corp.—Catalog on high-pressure gas cylinders.

128. Harris Calorific Co.—Folder 540710 on heating torch.

129. Heath Engineering Co.—Folder, "Automatic, Precision Metal Cutting."

130. Helmco, Inc.—Literature on flux pots for warming and maintaining brazing flux at constant temperature.

131. Hobart Bros. Co.—Information on a-c and d-c welders.

132. Hobart Bros.—Details on a-c power/d-c welder combination.

133. Hossfeld Mfg. Co.—Bulletin shows bender models, standard and special dies, and illustrations of bends.

134. International Nickel Co., Inc.—Folder, "Announcing Inco-Rod 'A'" on welding most dissimilar alloy joints.

135. International Nickel Co., Inc.—Technical Bulletin T-2, "Fusion Welding of Nickel and High Nickel Alloys."

136. Invincible Vacuum Cleaner Mfg. Co.—Folder on, "Invincible Flux Recovery Systems."

137. Kasson Die & Motor Corp.—Brochure giving complete specifications on the "SP-100" spot welder.

138. Lincoln Electric Co.—Bulletin 1343, "Now—Select The Idealarc For Every Job."

139. Linde Air Products Co.—Information on air-cooled "Heliarc HW-17" torch available for inert-gas-shielded-arc welding.

140. Liquid Carbonic Corp.—Catalogs and prices on "Gasweld" torches and regulators.

141. Mallory & Co., Inc., P. R.—Information on resistance-welding electrode designs.

142. Metal Bond Mfg. Co.—Catalog on soldering and welding products.

143. Miller Electric Mfg. Co., Inc.—Information on various arc welders.

144. National Carbide Co.—Write for name and address of nearest supplier.

145. National Welding Equip. Co.—Book on regulators.

146. North American Philips Co., Inc.—Folder on tungsten electrode welding.

147. Norton Co.—Data on selection of proper grinding wheels.

148. Page Steel & Wire Div.—Folder DH-402 sets forth analyses of automatic welding wire.

149. Reid-Avery Co., Inc.—Information on "Raco's" wire packaged and ready for production uses.

150. A. O. Smith Corp.—Information on how electrodes for manual welding were used on prefabricating tunnel sections.

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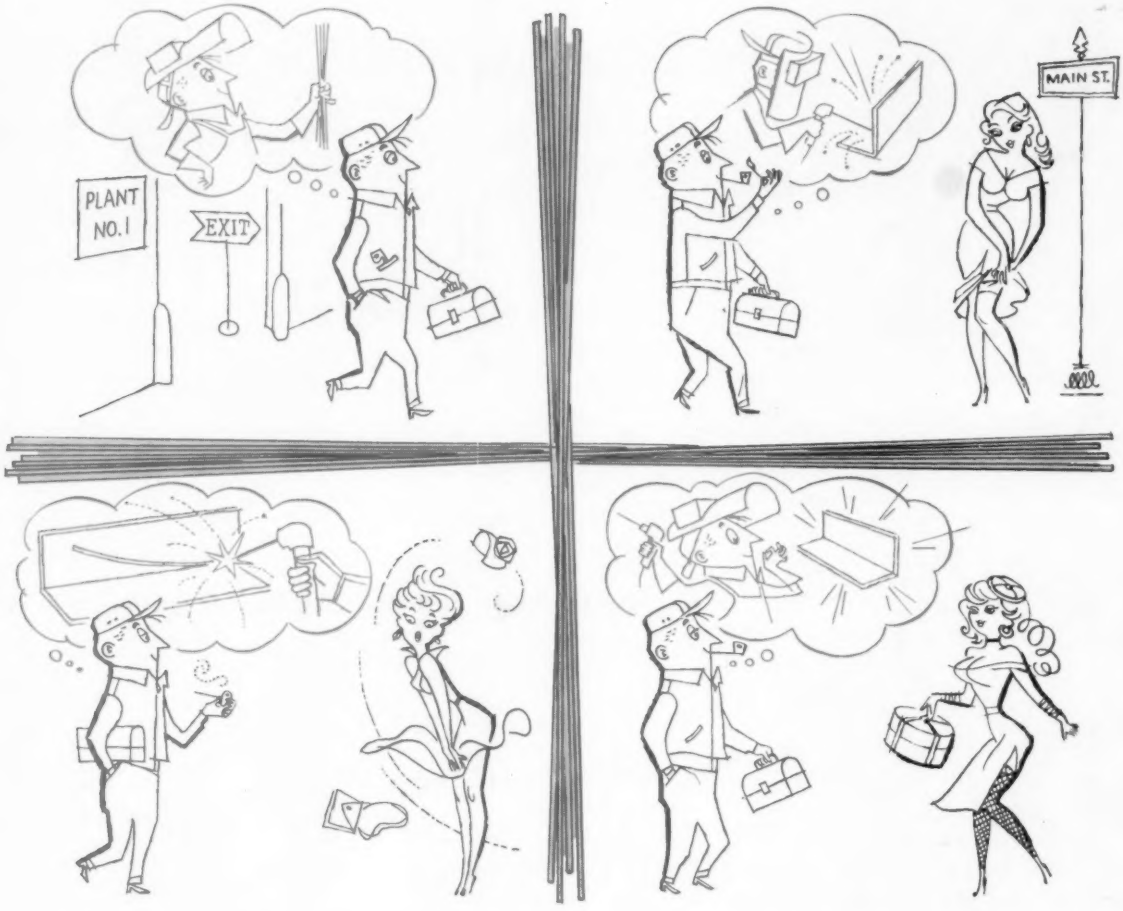

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